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PRACTICAL ROAD BUILDING.*

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CONCRETE CULVERTS AND BRIDGES.

ONE of the most important, and at the same time most neglected, phases of road work has to do with the construction of culverts and bridges. No matter what the state or condition of the road, these structures must be provided for the safety and convenience of the traveling public. It is the purpose of the writer to offer such suggestions regarding this work, as will be of practical value to the supervisor.

CONCRETE.

Concrete is a dense, rocklike mass composed of cement, sand, and stone or gravel. These ingredients are so proportioned that the cement will more than fill the voids or air spaces in the sand, forming a mortar; and the quantity of mortar must be sufficient to more than fill the voids in the stone. Upon the addition of water to a perfect mixture of the materials above, concrete is formed, the strength of which depends upon its density and the percentage of cement it contains. The value of the concrete then, is determined by the nature of the materials selected, and the proportions and thoroness of mixing. From this we see that it possesses no inherent quality that insures good results when improperly used; the mere fact that a structure is built of concrete in no way fixes its worth or durability. And on the other hand, well-made concrete is perhaps the most durable and permanent building material known. It is easily handled, lends itself readily to molding and shaping as desired, may be made from local materials, and its strength increases with age. It is practically everlasting. The first cost of a concrete structure is its last and only cost; there is no painting, no maintenance of any kind. But as noted, the materials must be handled with intelligence. The supervisor should thoroly understand the correct methods of proportioning and mixing the ingredients.

Cement. Only Portland cement of known and standard brands should be used. If the structure is to be placed in alkali soil, or subjected to the action of alkali water, the cement should preferably be "Alkali Proof" Portland cement, which has apparently proved itself able to withstand the disintegrating effects of alkali. If this brand can not be obtained, use standard Portland, but mix richer than for use under favorable conditions. It will not be necessary for the supervisor to test the cement, as its manufacture is so standardized that the quality of well-known brands is practically uniform. It is usually sold by the barrel, and is shipped in sacks of about 94 pounds each. It is customary to consider one sack of cement as equivalent to one cubic foot, and to use the cubic foot as the unit of measure. When stored or left on the work, the cement must be well protected by placing on a temporary platform and covering with heavy canvas, rubber sheeting, or other suitable material.

Sand. The sand used should be clean and sharp. In size it should range from ¼-inch down to fine. Sand screened from gravel thro a No. 4 screen will usually give excellent results. It must not contain more than 10 per cent. of clay or loam.

Stone or Gravel. The stone should be hard, durable material. If crushed, all dust is to be screened out, and no flat or scaley pieces used. For thin culverts and reinforced concrete the size of stone should vary from ⅜-inch to 1½-inch; for ordinary walls, stone up to 2½ inches may be used, and in heavy work larger stone will give good results. Gravel makes very good concrete, and may often be

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found at the bridge site. Sand should be removed from the gravel by screening, and then added in the correct proportions.

Water. The water must be reasonably clean, and free from alkali.

Proportioning. The proportions shall be by volume, the unit of measure being the sack of cement. The following may be used:

For reinforced concrete floor slabs, beams and girders, 1: 2: 4.

For plain culverts, concrete pipe, 1: 2½:5.

For abutments and wing walls, 1:3:6.

For heavy foundations, 1:3:7.

The expression 1:2:4 means: 1 sack (equals 1 cubic foot) of cement, 2 cubic feet of sand, 4 cubic feet of stone or screened gravel.

The supervisor must understand that 1 part of cement, 2½ parts sand, and 5 parts of broken stone will not give 8½ parts of concrete. The exact quantity will depend upon the percentage of voids in the sand and gravel, but probably not over 5½ parts of concrete will result. Again in using unscreened gravel and working to the proportions 1:2½:5, do not assume that one sack of cement should be used with 7½ cubic feet of natural gravel. If the sand were separated from this quantity (7½ ft.) of material, we would get about 6½ or 7 cubic feet of screened gravel, when only 5 cubic feet were wanted. A test should be made to determine the percentage of sand in the natural gravel, and only that quantity used that will give a mortar of the desired strength, to which may be added enough screened gravel to give the proper quantity of large aggregate. For instance, if it is desired to use natural gravel in the proportions 1: 2½:5, and upon screening several batches of 5 cubic feet of gravel it is found that 2½ cubic feet of sand and 4½ cubic feet of gravel are obtained, then to the 5 cubic feet of natural gravel may be added ½ cubic foot of screened gravel for each batch of concrete, using 1 sack of cement. If it is not desired to screen any of the material, use the natural gravel in the proportion 1:5.

As a rule, the voids in sand will not run over 40 per cent, and often less. In screened gravel of graded sizes, the voids are about the same. To determine the percentage of voids, proceed as follows:

Take a given quantity, say one cubic foot, of screened gravel, and place in a watertight vessel, shaking slightly. A cubical box 12x12x12 inches holds just one cubic foot, as does a cylindrical vessel 14⅞ inches in diameter and 10 inches deep. One cubic foot is approximately 30 quarts. Pour water into the vessel of stone or gravel, counting the number of quarts of water used until the water is just flush with the top of the stone. The water fills the air spaces or voids, and measures their volume. If 12 quarts are required to fill the voids in one cubic foot or 30 quarts of gravel, then the percentage of voids is 12 divided by 30, which equals 40. In the same way the voids in the sand may be measured, except that in this case the process is reversed, and the sand is poured into the water.

Another method of making this determination is as follows:

Weigh a given volume of sand or gravel, and call this weight G.

Weigh the same volume of water, and call its weight W.

Then,

$$\text{Percentage of voids} = \frac{(2.65 \times W) - G}{(2.65 \times W)} \times 100$$

If the volume used were one cubic foot, this equation reduces to

$$p = \frac{165 - G}{165}$$

While the method is the same, the above figures do not apply except when sand, gravel, or limestone is used. For other stone, substitute for 2.65 as shown below:

Trap	3.00
Granite	2.70
Limestone	2.60
Sandstone	2.50

Having ascertained the voids in the materials, we may proportion a dense concrete as follows: Use with any volume of sand enough cement to overfill the sand voids by 10 per cent. of these voids; then use with this mortar enough stone that the voids in the stone are overfilled by the same amount. For instance, assume the voids in the sand to be 36 per cent., and in the gravel 40 per cent. Thirty-six per cent. plus 1-10 of 36 per cent. equals approximately 40 per cent. Therefore, we will use 2½ volumes of sand for each volume of cement. Then 40 per cent. plus 1-10 of 40 per cent. equals 44 per cent., and we know that 2½ volumes are 44 per cent. of the quantity of stone to be used, which we find to be 5.7 volumes. A perfectly good and dense concrete, under the assumption, would be proportioned as below:

One part cement, 2½ parts sand, 5½ parts stone or screened gravel; and the volume of concrete would be a little less than 6, due to the slight excess of mortar used. These points are mentioned that the supervisor may know how to proportion the materials economically. As the strength of concrete depends upon the amount of cement it contains, as well as upon its density, and as reinforced concrete structures demand concrete of maximum strength, the proportion noted above for reinforced concrete: namely, 1:2:4, will be used for such purpose.

Mixing and Placing. Given good mate-

rials, the real value of the structure depends upon the thoroness of mixing and the care used in placing the concrete. Machine mixing is always preferable to hand mixing, but except on large jobs or a number of small ones, is not economical. When a machine mixer is used, it should be of the revolving drum type.

The materials should be placed in the mixer in measured batches, and not shoveled in, and depending on a count of the shovelsful to determine the quantity. A few trial batches should be run out, dry, and the number of revolutions of the drum determined that will give a uniform mix. In all cases the materials should have some dry mixing before the water is added.

Altho machine mixing is to be preferred, ordinarily the concrete will be mixed by hand, and satisfactory results may be obtained if care is used in so doing. If screened stone or gravel is to be used, proceed as follows: Make a mixing platform by nailing planks on 2x4-inch stringers spaced about three feet apart. The plank should be dressed on the top side and laid with close joints. The platform should be at least 8x10 feet, around the edges of which are nailed 2x4-inch strips laid flat, to prevent water running off the board. A bottomless box of suitable dimensions, with narrow strips nailed on the sides near the top for handles, is used for measuring materials.

Spread the sand for one batch in a thin layer, and over it spread the cement. These materials are then mixed by turning with short-handled shovels. Two or four men face each other on the platform and turn the mixture towards the edge of the board, with a spreading motion of the shovels, as the sand and cement leave them. The materials are then turned back, and this operation is repeated until the mass has been turned at least three times, or until it has an even, uniform color. The mixture is then spread and mixed with enough water to form a wet, but not sloppy mortar. The stone is placed on the mortar and the whole turned until every fragment of stone is coated with mortar, when it is ready to place. Sometimes the stone is placed and mixed with the dry sand and cement before the water is added. In any event, the sand and cement must be mixed dry until of a uniform color, and the whole mass mixed wet until the stone is uniformly coated with mortar.

In using unscreened gravel, place the gravel in a thin layer, spread the cement and mix dry before adding the water. A wet, but not fluid, mix will be found to give the best results.

Concrete may be wheeled or shoveled into place, as is the most convenient. Steel barrows are best for wheeling. As the concrete is deposited in the forms, it should be carefully spaded, so as to expel all air, and the stone worked back from the forms in order to get a smooth surface. It must be worked in and about the steel reinforcement, if any, being careful not to disturb the steel and to leave no air pockets. Do not attempt to use a plaster cast on the concrete surface. If a more uniform surface is desired than is obtained by using oiled, dressed lumber for forms and spading, the concrete may be rubbed with a wooden float as soon as the forms are removed; a little water dashed on the surface will aid in floating. After floating, the surface may or may not be painted with a cement grout.

Forms. The lumber for forms must be sufficiently heavy and braced to hold the weight of the concrete. Ordinarily, 1½-inch to 2-inch stuff is used, except for light work, when 1-inch material will do if properly braced. Cut the lumber as little as possible, so that it may be used several times. Forms for walls, abutments, etc., are held together with wires; all forms should be dressed on the inside and oiled with crude oil or softsoap.

The time that forms should remain in place depends on the cement used and the weather conditions. With a wet mix in warm weather, wall forms may be removed usually in two to four days. Small culverts require about the same time, but should not be loaded immediately. Bridge floors, beams, etc., should be left in the forms for one or two weeks, leaving the false work under the structure for three weeks or longer. In all cases the forms must be left on until the concrete has set sufficiently to stand. The supervisor must be sure that the forms are not removed too soon. When alkali-proof cement is used, it will be found to harden more slowly than ordinary Portland, hence it must be left in the forms for a longer time.

Green concrete must never be exposed to the direct rays of the summer sun. In hot weather the work should be covered with canvas or other protection, and sprinkled at least once a day for five days. Concrete requires moisture for hardening; and when the weather is warm and the evaporation rapid, the moisture that is thus lost must be supplied by sprinkling. This is a very important point. Quite frequently well-made concrete is porous and crumbly because it has been permitted to dry out before hardening.

Safe practice would suggest no concreting in freezing weather. If, however, the temperature suddenly drops while the work is in progress, the following precautions should be observed:

Procure an old smoke stack and cut longitudinally into two pieces, so as to give two semi-circular forms about eight feet long. Place these on the ground a few feet apart, build a fire under them

and shovel the sand and stone over and about them. This is done to heat the materials. Also heat the water, with which may be used common salt equal to 10 per cent. of weight of water. The use of the heated materials and salt lessens the chance of freezing before setting. The concrete in place must be protected by covering with canvas, over which may be spread a thin layer of earth or manure. Never permit manure to come in contact with new concrete. As the concrete sets more slowly in cold weather, the forms must be left in place for a longer time.

Concreting Under Water. Quite frequently it is necessary to place concrete in a trench that is partly filled with water. Especially is this true when building wing walls and abutments. Under such conditions the following precautions should be observed: First, before starting the excavation, it is wise to drive a double row of 2x6-inch sheet piling about the trench line, breaking joints and allowing plenty of room for the trench. Place mud or sacks filled with mud against the inside of the sheet piling, to aid in keeping out the water. Bail out (or preferably pump out with a hand pump) all the water that can so be removed. Continue the excavation to the required depth, pumping at the same time if necessary. Place the forms as quickly as possible. Mix the concrete that is to be placed under water (there will usually be some leakage) somewhat dry, but add some water; that is, never place perfectly dry cement and gravel in water and depend upon this trench water to properly wet the concrete. Having mixed the concrete as noted, it may be placed under water by means of a wooden bucket with a door opening downward from the bottom, or by means of a tight, closed chute, or by placing in cement sacks which are lowered to the desired location. The particular difficulty to be overcome is the separation of the materials which will weaken, if not render absolutely valueless, the concrete. Under no circumstances should concrete be shoveled into a trench in which there is any appreciable amount of water. If the sheet piles are driven with care and some effort made to render them water-tight, a very unpleasant condition may be removed, and the concreting continued with every assurance of success.

In no other type of construction does the personal equation enter so strongly. Given good materials and correct proportions, the strength and value of the product is wholly dependent upon the judgment exercised in mixing, placing and curing the concrete.

BALTIMORE SEWAGE DISPOSAL PLANT.

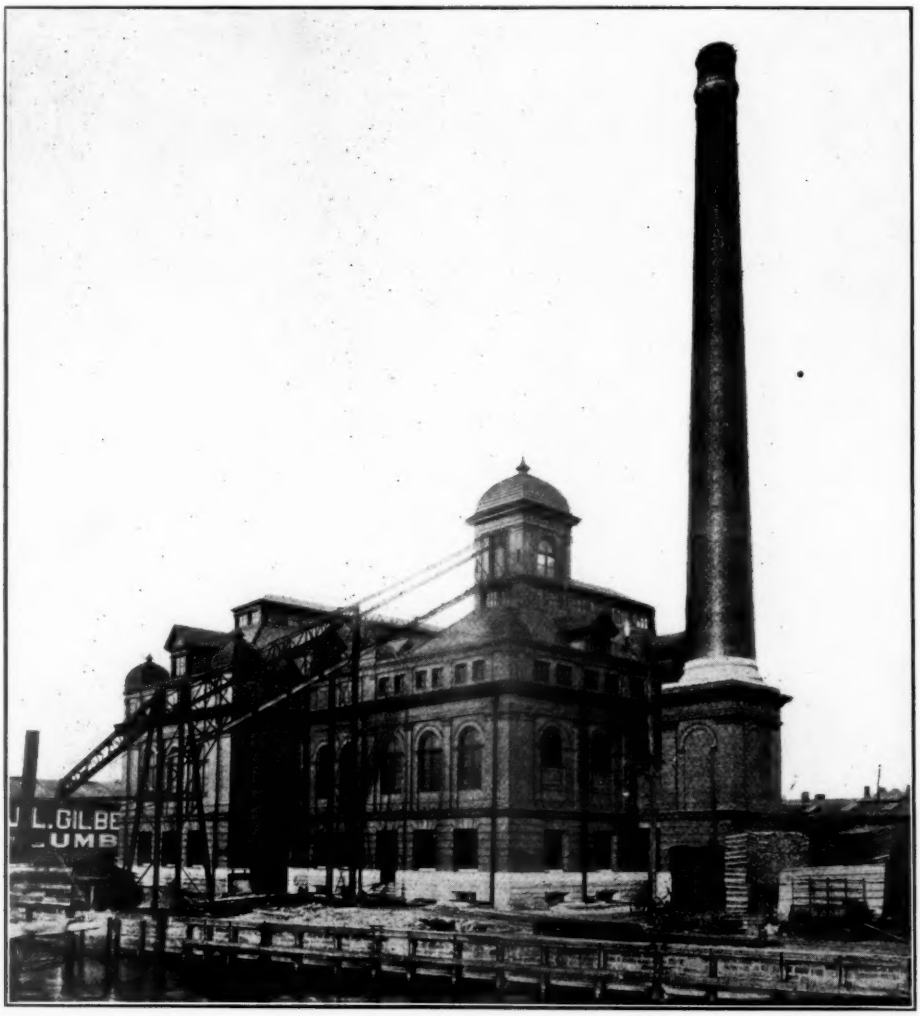
IN the general description of the sewerage system given in the July issue of MUNICIPAL ENGINEERING by Stuart Stevens Scott, a general idea was given of the magnitude and difficulty of the problem of providing Baltimore with a complete system of sewers. The very magnitude of the work as well as the more interesting points warrant a more complete account of various parts which go to make up the system.

The legislature of the state of Maryland, in 1909, provided that a disposal system should be constructed to provide the "highest practicable degree of purity" before the sewage should be discharged into Chesapeake bay. A board of engineers chosen to make recommendations to this end stated that the disposal system should include preliminary settling tanks, sprinkling filters, secondary settling tanks and intermittent filters, which would provide at least one operation in the purification more than is demanded in most cities. These recommendations were made in 1906, and it was substantially according thereto that the system was constructed, except for the fact that the intermittent filters were regarded as unnecessary, provision being made for the treatment between the filters and secondary settling tanks with hypochlorite of lime.

All sanitary sewage from the low level district flows by gravity to the disposal plant, but about one-third of the total amount of sewage which will reach the disposal plant must be raised against a total head of 72 feet.

Provision was made in designing the pumping station for a population of 1,000,000, and five 27,500,000-gallon-per-24-hour pumps will be installed ultimately. It is estimated that two of the pumps will take care of the maximum flow for that population, leaving the other two to be worked alternately then, and a fifth for emergency service in case of breakdown. Three of these pumps are already installed and ready for service.

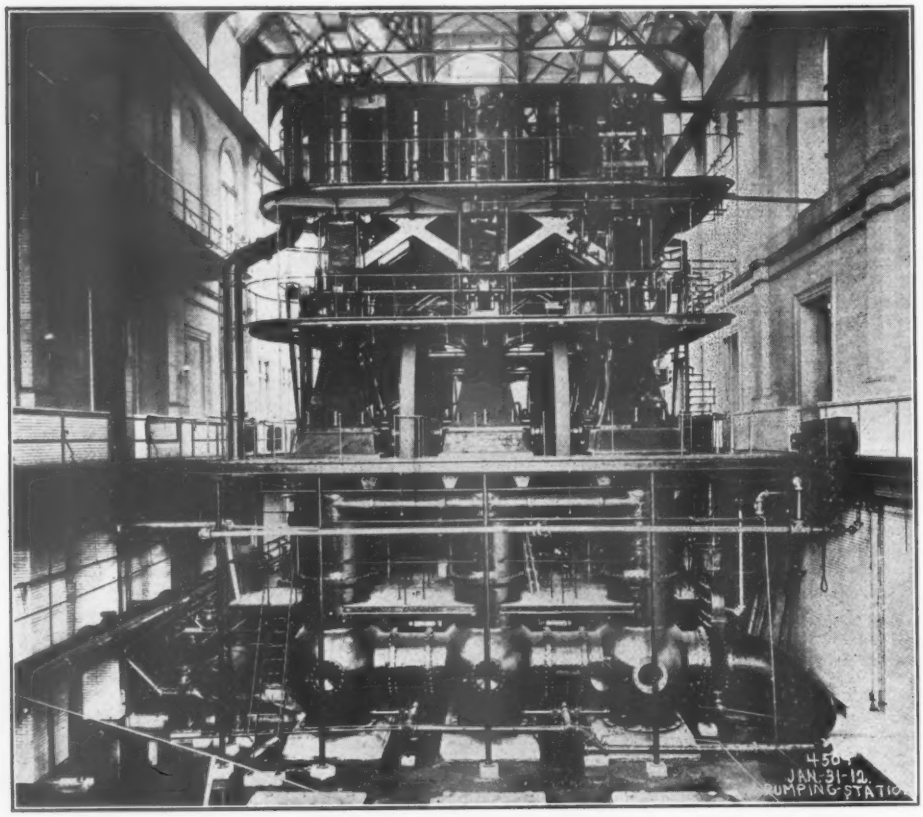
The pump station building contains in addition to the pump and engine room, boiler room and screen chamber, offices for the station superintendent, drafting rooms, store rooms, etc. The engine room is 180 feet long, 54 feet wide and 68 feet



BALTIMORE SEWAGE DISPOSAL.
Exterior of Low Level Pumping Plant.

high to provide for the enormous pumps. It is lined with enamel brick for its full height. Besides the five pumps mentioned this room will contain two drainage pumps, valves, piping, etc., and a twenty-ton electric crane.

The sewage pumping units are vertical triple-expansion crank and flywheel condensing engines, having three steam cylinders, 22, 41 and 62 inches in diameter, and three single acting plungers 40 inches in diameter, all of 60-inch stroke.



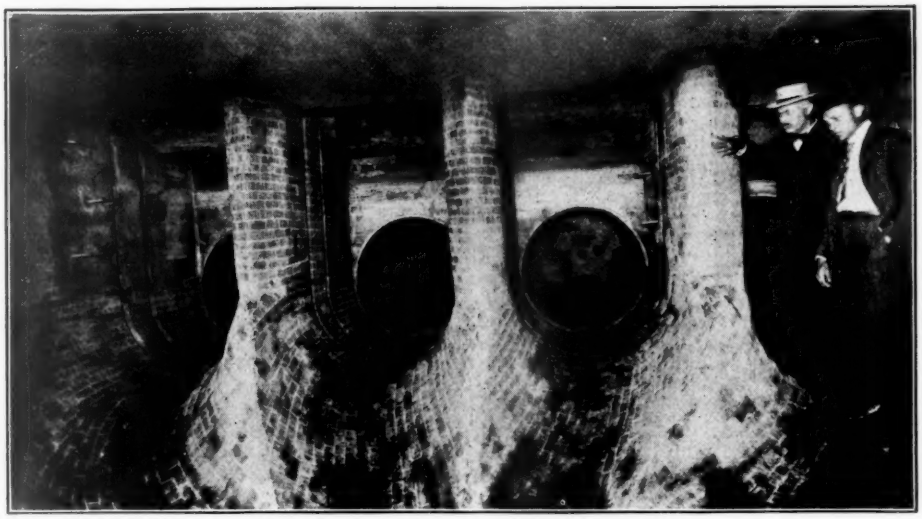
BALTIMORE SEWAGE DISPOSAL.
Pumping Unit at Low Level Pumping Plant.

The pumps operate at 20 r.p.m. The discharge is thru 42-inch force mains leading to the disposal plant. The drainage pumps are provided to pump the water from the under drains laid beneath the intercepting sewers, discharging it either thru the condensers of the large pumps or into an outer drain, as desired. There are two 12-inch centrifugal pumps operated by 40 h.p. compound condensing engines. The pumps have a capacity of 3,000 gallons per minute, each.

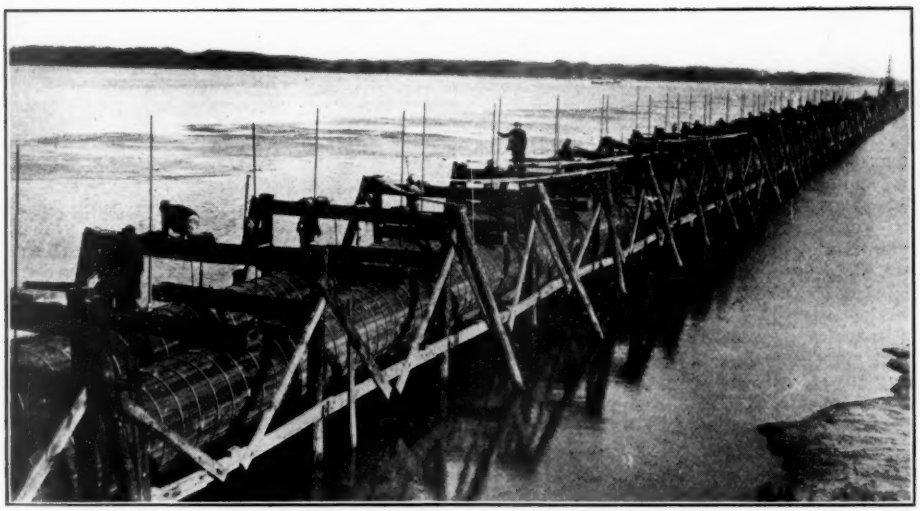
The raw sewage in the low level district flows directly from the intercepters into a screen chamber located between the pump room and the boiler room. Here it is screened, first thru a set of movable screens, and then thru fixed screens over suction pipes of the pumps. These screens remove the coarser elements, such as small sticks, rags, toys, etc., from the sewage, so as to prevent clogging of the pumps.

After leaving the pumping station, the sewage from the low level district flows thru the force mains, previously mentioned, to the disposal plant, where it is handled together with that which flows by gravity from the high level district. A photograph shows the discharge chamber at the upper end of the force mains from the pumping station.

The sewage from the main outfall sewers is first screened thru a series of coarse screens consisting of stationary iron bars with ⅞-inch openings serving the same purpose as the fixed screens at the pumping station. These screens are at present cleaned by hand by means of rakes, tho it is probable that some me-



BALTIMORE SEWAGE DISPOSAL.
Force Mains Entering the Discharge Chamber.



BALTIMORE SEWAGE DISPOSAL.
Lowering Sections of Wooden Outfall.

chanical cleaning device will be adopted later.

All sewage which enters the disposal plant is first measured thru a Venturi meter, having a diameter of 42 inches at the entrance and with a 21-inch throat casting. Recording dials register the flow of sewage in units of millions of gallons per day, and keep a record by the week of the total amount treated.

The first process in the disposal plant consists in passing the sewage thru the hydrolitic or settling tanks. The passage thru these tanks requires about eight hours, allowing time for the solids to settle, after which the liquid remaining passes on to the gate house. The hydrolitic tanks are about 450 feet long, and have a capacity of 4,000,000 gallons. The bottoms of the tanks are built on a slope and have channels along them to allow the sludge to be more easily removed. From the hydrolitic tanks the sludge is washed thru floor drains into conduits, and thence into a main pump well. From this well it is forced thru a series of 12-inch mains to the sludge digesting tanks. The sludge pumps are electrically driven centrifugals, receiving their power from the turbine plant operated, as will be noted later.

The sludge passes into digesting tanks, which are three in number, and have a capacity of about 1,400,000 gallons. Here the bacterial action within the sludge is carried on under clear water, after which it is removed to drying beds.

The sewage after the sludge is removed passes on to a gate house, after passing thru a series of fine screens of the rotary drum type, where all matter which might perhaps clog the nozzles of the sprinkling filters is removed.

From the gate house the sewage is applied to any one of a number of filter beds located at a level of about fifteen feet beneath the hydrolitic tanks. This provides a sufficient head to cause the liquid to be sprayed over the stone beds and filter down thru about 8½ feet of broken stone ranging in size from 1 inch to 2½ inches. The sprinkling nozzles throw a square spray so as to utilize the greatest possible area of the filter surface, and a very ingenious arrangement of the cam-driven butterfly valves regulates the flow, causing it to pulsate and so throw the spray at varying distances from very close to the sprinkling heads to the most remote points of the filter beds. Twelve acres of these filter beds are now in service, and the sewage is applied thru about 2,400 nozzles.

The spraying action provides sufficient aeration for the sewage, and the succeeding operation as the liquid is finely divided in passing down thru the stone beds allows of the completion of the bacterial action.

After leaving the filter beds the sewage is practically purified. It is drained off from the floor to a central channel and thence into settling basins, thru which it requires three hours to pass. These settling basins serve merely to rid the liquid of any sediment which remains, which sediment is practically sterile, and, in fact, little different from the soil which is stirred up in a river during flood seasons.

The next stage in the progress of the sewage thru the plant is one of the most unique features of the Baltimore disposal system. An 18-foot drop was available at this point before the liquid was discharged into the outfall pipes. Two turbines are at present installed, and another will soon be added, which make use of the power available from this drop. These turbines are connected to 110 k.w. generators which will supply current to run a 600-gallons-per-minute centrifugal pump, which will lift the purified liquid from the sewage to an elevated tank from which it may be used for washing the sludge from the sludge beds, etc., and also sufficient current to light the plant thruout, and operate various small motors which control some of the operations in the plant.

From the turbines the liquid flows into Back river thru two five-foot wood-stave pipes, each 2,500 feet long. The accompanying photograph shows the method of lowering these pipes into their places on the river bed. They were constructed on trestle built out into the river, both pipe lines being constructed at the same time and in 1,250-foot sections. They were then suspended by means of bands and vertical threaded rods to the trestle as shown. Then with a man at each bend of the trestle, operating a wrench on the nuts suspending the rods, they were gradually lowered to the river bottom, the operation being assisted by boxes of sand added to give additional weight. The two halves of each pipe line were then joined beneath the water by divers.

The disposal plant is operating with only a small amount of sewage at the present time, for only a small percentage of the connections have been made. If the work proceeds with the same rapidity as it has in the past, it is probable that all of the sanitary sewers mentioned in the sewerage commission report in 1906 will be completed in 1914. The number of units now ready for service will purify the sewage from about 275,000 people. The cost of both the sanitary and storm water systems complete will be approximately $20,000,000.

Calvin W. Hendrick, formerly in charge of sewer construction for New York City, directed the design and construction of the entire sewerage work. Ezra B. Whitman was resident engineer, and H. C. McRae was engineer in charge of the works.

PAPERS BEFORE THE AMERICAN WATER WORKS ASSOCIATION.

ELECTROLYSIS FROM STRAY ELECTRIC CURRENTS.

By Albert F. Ganz, Professor of Electrical Engineering, Stevens Institute of Technology, Hoboken, N. J.

ELECTROLYSIS is defined as chemical decomposition by means of electric currents. Stray electric currents, escaping from grounded electrical distribution systems which reach underground pipes, cause destruction from electrolysis where these currents leave the pipes for the surrounding soil, because soil is an electrolytic conductor. Theory and experience show that the weight of metal destroyed by electrolysis is independent of the voltage, except insofar as this determines the amount of current produced, and that this corrosion is directly proportional to the amount of current leaving the pipe and to the time during which it leaves.

In practice the only serious sources of stray currents are single trolley direct-current electric railways. In these railways the running tracks are used as the return conductor, and for this reason they are connected to the negative bus-bar at the power station by return feeder cables. In most systems the tracks are connected to the negative bus-bar directly at the power station, and there are many systems where there are no further return feeders. The running tracks of such single trolley railways are usually in contact with ground; and since there is a drop in voltage in the rails, current leaks from the rails to flow thru ground, the amount of stray current depending upon the drop in voltage in the rails and upon the resistance of the path thru ground. Since electric current can only flow in a closed circuit, all current which leaks from rails and flows to ground and on underground pipes must again leave these pipes where negative return feeder cables are connected to the rails, in order to flow back to the negative terminal of the generator and so complete the electric circuit. Where these stray currents leave these underground pipes to flow to the surrounding soil, electrolysis corrosion is produced, resulting in a destruction of 20 pounds of iron in one year for every ampere of current. It has been disputed whether the amount of destruction produced is always equal to the theoretical amount; a number of laboratory experiments made recently by the author under practical conditions with current densities as low as those found in practice on underground piping seem to indicate that the actual amount of destruction is always at least equal to the theoretical amount, and is often even greater than the theoretical amount.

Since stray currents flowing thru the ground and thru underground piping are caused by potential differences between the pipes and rails set up by the drop in voltage in the rails, the simplest way to determine the probable existence of stray current on underground piping is to measure the potential differences between pipes and rails. Such measurements made thruout a system constitute the usual potential survey. These potential differences are, however, not a measure of the current flow between pipes and rails, as this is determined also by the resistance of the path thru the intervening ground, and this resistance cannot be practically measured. Since the actual electrolysis danger of a pipe is determined by the amount of current flowing on the pipe, it is necessary to make current measurements at many points thruout a piping system. The existence and direction of current flow on a pipe can be determined from drop measurements between service connections, but the magnitude of the current flowing cannot be determined from such drop measurements. To determine the actual amount of current flowing, a length of pipe is exposed and the drop in potential along a known length of continuous pipe is measured, and this drop is divided by an assumed resistance for the included length of pipe.

Since the positive potential of a pipe referred to rails, plus the negative potential of the pipe referred to rails, plus the drop in the pipe, is equal to the drop in the rails; the potential and current surveys enable one also to form an estimate of the drop in rails, and thus to form an idea as to the condition of the railway return circuit.

After drop and current measurements have been made at a sufficient number of points, they are conveniently plotted on a mains map, and a study of this map will indicate where current is leaving the pipes. Such points will always be found in the regions where the pipes are positive to the rails. Other points remote from the positive region will in most cases also be found where current leaves the pipes to flow to other pipes or to

other underground metallic structures, or to flow to ground in cases where the negative bus-bar is grounded thru low resistance ground connections. The author has found large stray currents leaving water pipes in districts where these pipes were from ten to twenty-five volts negative in potential to the trolley rails, and more than five miles away from the railway power station. At points where the current survey indicates current leaving, excavations should be made and the pipe examined for evidences of electrolytic corrosion.

Besides the danger from electrolytic destruction of the pipes, stray currents where they flow on underground piping systems frequently enter buildings thru service connections and produce a serious fire hazard. For example, current may flow into a building thru a water service pipe, then flow from the house water piping to the house gas piping, and then out from the building thru the gas service pipe. Such contacts between service pipes or between a service pipe and the lead sheathing of a telephone or a power cable frequently occur thru metal ceilings or where the pipes rest against each other. Since dangerous heating may be produced where the current flows thru such contacts or where vibration may momentarily separate the contact and produce an arc, nearby inflammable material is in danger of being set on fire. The author has in fact found many cases where currents up to 30 amperes were flowing into and out of buildings thru service pipes or lead cable sheaths. Evidences of arcing having occurred between such contacts in buildings have also been found. There is no doubt that many fires have started in this way, but it is always difficult to prove the cause of a fire because of the destruction resulting from the fire.

There is only one complete remedy for electrolysis and that is the use of a completely insulated return circuit. Such railways may be provided with double overhead trolley wires, as used, for example, in Washington, D. C., Cincinnati and Havana; or with an insulted outgoing and return conductor in underground conduits, as used, for example, on the surface lines on Manhattan Island; or with separate insulated third and fourth rails for the outgoing and return current, as is used on the Metropolitan District railway in London. With these systems the running tracks are not used as a part of the electric circuit, and as both positive and negative sides of the circuit are insulated no stray currents are produced.

Where a road operates on a private right-of-way, the rails can often be practically insulated from ground and the escape of current from the tracks prevented. For surface roads this can be practically accomplished by placing the rails on wooden ties above ground and using broken stone for ballast and keeping the rails out of contact with ground. In the case of railway lines operating on elevated structures, the rails can be fastened to wooden ties and kept out of contact with the structure. These rails, supplemented where necessary with negative feeder cables, also insulated from the structure, can then be used for the return conductor. In this way the return circuit is quite thoroughly insulated from the elevated structure and from ground, and stray currents are entirely prevented.

A number of remedial measures intended to reduce stray currents from electric railways using the grounded rails for a return conductor have been tried. These methods may be divided into two classes, the first class aiming to remove the current harmlessly from pipes by metallic connections or bonds between the pipes and the railway return circuit, and the second aiming to minimize stray currents thru ground.

Since stray currents cause damage only where they leave pipes to flow to the surrounding soil, attempts are frequently made to prevent destruction from electrolysis by connecting or bonding the pipes or other structures by means of metallic conductors to the rails or to the negative return circuit, so as to remove the electric current by metallic conduction and thus prevent corrosion from electrolysis. This method can protect lead cable sheaths because they form continuous electrical conductors, but is not generally applicable to underground piping systems, because the latter do not form continuous electrical conductors, but are more or less discontinuous networks. While lead calked joints usually have a relatively low resistance, it frequently happens that they develop such high resistances as to make them practically insulating joints, due undoubtedly to the formation of oxide coatings. Cement joints and cement pipes have such a high resistance compared with iron pipes that they are practically insulating. Bonding of pipes to the rails or to the negative return circuit can only afford local protection to the extent that the piping connected forms a continuous metallic conductor, and this latter is an unknown and uncertain quantity in a piping network. In the practical working out of a bonding or drainage system two opposing tendencies develop. First, there is a reduction in the difference of potential between pipes and rails in the positive areas and consequent reduction of damage in those areas. Second, there is an increase of current flow on the pipes thruout the entire system, thus increasing the danger of trouble at high resistance joints or other places where two piping systems,

or separate portions of the same system, are electrically discontinuous. As a rule, in the early stages of this system, and especially in small networks when there are comparatively few bond connections and the resistances of the paths over the pipes are therefore relatively high, the effect is apt to be beneficial, reducing the danger in positive areas more than it increases the danger elsewhere. As the system grows and the load increases, more and heavier bonds become necessary. The current on the pipes may finally become so great that the trouble from current shunting around joints or between separate systems will increase more rapidly than the danger in the positive areas is reduced, and any further increase in the bonding becomes an actual source of danger to the system. Since bonding transfers the trouble from the region where it was most evident to a new locality where it may require several years to manifest itself, the false impression is created that the trouble has been removed. It is largely this obscure and slow manner in which trouble develops that has caused this method to become quite widely used. A number of cases have been reported where a main bonded to the negative return circuit at the power station was completely destroyed from electrolysis a block or two away because of a high resistance joint in the main, forcing the current to shunt around the joint and leave the main a short distance away from the power station. In one of these cases one entire block of main had to be replaced. In another case the water main on one side of the street was bonded to the negative return circuit at the power station, and a main on the opposite side of the same street, altho connected thru cross-piping to the bonded main, was completely destroyed because high resistance joints had developed in the connecting pipes. In addition, bonding pipes as a means of protection always renders the bonded structures a part of the negative return circuit, and therefore a source of danger to other underground structures which are not bonded. It has, in fact, been frequently found that where gas or water service pipes cross-bonded cable sheaths, currents are induced to flow from the service pipes to the cable sheaths and produce gradual destruction of the service pipes. In the case of one city, nineteen service pipes were destroyed in the course of one year directly where these pipes cross telephone ducts containing cables whose sheaths are bonded to the railway return circuit. One engineer, who has studied this problem very carefully and entirely impartially, has very aptly likened bonding to the drug habit, producing temporary relief at the expense of permanent and perhaps irreparable injury to the victim, which injury is, however, too rarely attributed to the true cause.

Experience shows that where there is serious trouble from electrolysis caused by large stray currents leaking from the street railways, the bulk of this trouble is due to defective rail bonding, to ground connections from the negative bus-bar, and to lack of return feeders to bring the current back from the rails to the power station. While stray currents can only be entirely eliminated by insulating the return circuit by the use of a double trolley, either overhead or in conduit, it is, nevertheless, a fact which is not generally appreciated, that where large stray currents exist, these can always be reduced to a small fraction of their present value by removing all ground connections of the negative bus-bar and installing insulated return feeders proportioned for equal drop from radially-disposed points in the track system located at some distance from the power station. By this method the rails are drained of current, and any desired part of the voltage drop can be removed from the rails and transferred to insulated conductors from which currents cannot leak. In Europe such radial insulated return feeders for bringing current back from the rails to the power station are made necessary by regulations limiting the allowable drop in voltage in the rails, and in most cases such installations of insulated return feeders have substantially removed serious trouble from electrolysis. This system of minimizing stray currents by the means of radially-disposed insulated return feeders has also been installed in a number of American cities, and the method is gradually being recognized as by far the best for minimizing stray currents. This system, in fact, removes the root of the trouble by draining the rails of current and removing voltage drop from the rails and thus preventing substantial leakage of current thru ground, and is therefore correct in principle. The railroad companies frequently object to this system, claiming that it is prohibitively expensive. This is certainly not the case, as is evidenced by the fact that the method is in general use in Europe and in a number of American cities today. The fact is that in many electric railways there is practically no installation of negative feeders and the railway companies are often not willing to install even a moderate amount of return feeder copper. A mistake is often made in confusing the radial insulated return feeder system with paralleling the rails with copper. Of course where the negative bus bar is connected to the rails at the power station, and these rails are paralleled with copper feeders, the drop in the rails is reduced in the proportion that the conductivity of the return cir-

cuit is increased, but no part of the drop is actually removed from the grounded rails. The amount of copper paralleling the rails that would be required to reduce stray currents to a negligible amount would in all large systems be absolutely prohibitive. This, however, is not the case with the radial insulated return feeder system. With the latter system any desired reduction in rail drop and consequently in the amount of stray current can be secured, independent of the amount of copper installed, the amount of copper being determined by the allowable drop or power loss in the return circuit. The railway company can divide the annual charge of interest on copper invested and operating expense in any ratio within wide limits without affecting the amount of stray current produced from the system. The pipe owning companies suffer constant expense on account of stray railway currents in the form of repairs and depreciation of their underground structures, and in the form of liability for accidents, and this can be reduced with certainty to any desired extent, short of complete elimination, by the assumption on the part of the railway company of expense in the form of interest and power charges for its return circuit. The railway companies should in all fairness assume this expense and responsibility. If the railway companies would apply as much engineering knowledge and money to their negative circuits as they do to their positive circuits there would be but little trouble from electrolysis. The pipe owning companies should co-operate with the railway companies by affording them access to their pipe for making necessary measurements, etc. After a railway company has installed a reasonable and fair return circuit, it sometimes happens that it is desirable to eliminate any remaining current on pipes by the use of properly located insulating joints. Under these circumstances the pipe owning companies should be willing to co-operate with the railway company in the installation of such joints.

In the decree recently filed in the celebrated Peoria case, the railway company is enjoined and restrained from injuring the property of the water company by electric current escaping from the rails or structures of the railway company. No particular method for preventing escape of current is prescribed in the decree, because the Court in its decision has already stated that a Court does not have the power to prescribe by injunction any specific system, and that this power resides only with the legislative bodies. In its decision the court, however, lays great stress upon the insulated radial return feeder system, which is spoken of as a quadrilateral system. The decree also requires the water company to cooperate with the railway company to the extent of giving the railway company access to its piping system for the purpose of measuring flow of current upon its system, and of determining whether injury from electrolysis is being continued, in order that the railway company may determine whether it is complying with the terms of the decree. It is evident from this decree that the expense of providing a proper return circuit for the railway system so as to minimize escape of current falls entirely upon the railway company as it should in all fairness. One section of the decree states that within six months after the expiration of one year after the date of the decree, the railway company may apply for a hearing on the question whether it should be permitted to make an experimental use of the drainage system, in order to ascertain whether such drainage or limited use thereof can be practically applied to the piping system. It appears from the decision and the decree that the railway company must within one year improve its return circuit so as to prevent as much as possible the escape of stray electric currents from its system. If, after this has been done, it is found that stray currents still exist on the piping system, then the railway company may apply to the Court for a hearing to determine whether the water company should be directed to permit the railway company to try a drainage system as an experiment to remove the remaining current harmlessly. A drainage system such as contemplated as a possible final measure by the Peoria decree, when properly controlled so that only small currents are drained from the pipe, does not have the objectionable and dangerous features of promiscuous bonding where large currents are made to flow on the pipe as often found in American cities, and may even be a safe final method where the soil conditions are favorable and where the underground structures are all continuous electrical conductors. It nevertheless seems to the author very unfair that any pipe owning company should be compelled by a Court order to permit an electric railway company to use its pipe as a return conductor for its railway system, even to the slightest extent. If the Court does not have the power to compel the railway company to adopt any specific method for eliminating the danger from electrolysis, then it certainly should not impose any specific method upon the pipe owning companies. The latter may for example prefer to remove any small remaining stray currents by means of properly located insulating joints.

It is the author's firm conviction that such remedial measures as pipe drainage or insulating pipe joints should be used if

at all only as a final measure and never until the return circuit of the railway has been improved so that only small amounts of stray current remain on the underground structures. This view appears to be entirely in accord with the Peoria decision, and is certainly in accord with the best engineering practice.

THE WATER WORKS OF NEW YORK.

By Edward Wegman, New York City.

THE greatest water works of modern times are, beyond question, those of the city of New York. Prior to 1774 the inhabitants of this city obtained the water required for domestic purposes from the public wells, which were generally placed at the street corners. The first of these wells was sunk in 1658 in front of the old fort at Bowling Green.

In 1774 the first public water works were constructed for New York, according to plans prepared by Christopher Colles, an English civil engineer. Water was pumped by steam engines from the old "Collect Pond," which occupied the space where now stand the Tombs and the surrounding blocks, to a reservoir constructed on the east side of Broadway between Pearl and Walker streets. The water was distributed through hollow logs laid in the principal streets of the city. Owing to the insufficient supply and the confusion caused by the revolution, these works were soon abandoned.

In 1799 the Manhattan Company obtained a charter for supplying the city of New York with pure and wholesome water. This company sunk some wells near the northwest corner of Reade and Center streets, from which water was pumped into a reservoir built on the north side of Chambers street, between Broadway and Center street, whence the water was distributed through hollow logs. The supply furnished by the Manhattan Company was insufficient in quantity and bad in quality.

In 1834 the legislature of the state authorized the city of New York to obtain a supply of "pure and wholesome water" from Croton river. The works necessary for securing this supply were constructed in 1837 to 1842.

A "fountain reservoir" was formed by building a dam, 50 feet high, across the Croton river, about nine miles above its mouth. From this reservoir the water was conveyed to the city in a masonry conduit, 8 ft. 5½ ins. high and 7 ft. 5 ins. wide. For the greater part of its length the aqueduct followed the east bank of the Hudson river, being generally built as "cut and cover work." Small mountain spurs were pierced by tunnels and valleys were usually crossed by dry stone embankments on top of which the conduit was built. The Harlem river was crossed by a fine aqueduct bridge, having fifteen semi-circular arches, viz.: eight of 80 feet span and seven having spans of 50 feet.

The works described above were first put into service on July 4, 1842. For nearly fifty years they supplied the city, altho they were severely strained to keep up with the increasing consumption. According to the original plans, the Old Croton Aqueduct, as the conduit described above is now called, was only to deliver about 36,000,000 gallons per day. To keep up with the consumption this conduit was forced by 1880 to deliver about 95,000,000 gallons daily.

In 1880 to 1884 a small additional supply of 23,000,000 gallons per day was obtained from the Bronx and Byram rivers.

In 1884 to 1891 a second aqueduct, having a capacity of about 300,000,000 gallons per day, was built from the Croton valley to the city of New York. This conduit, known as the New Croton Aqueduct, is 13.53 feet high and 13.6 feet wide. From the Croton valley to a terminal gate house at 135th street and Convent avenue in the city, the new aqueduct was constructed entirely in tunnel, with the exception of a few short sections, aggregating 1.12 miles in length, where the conduit was built in open cut. The Harlem river was crossed by a siphon tunnel, about 1,300 feet long, excavated about 300 feet below tide. From the gate house at 135th street and Convent avenue the water was connected with the distributing pipe system by eight lines of mains, each 4 feet in diameter. The new aqueduct was put into service in 1890. Its construction cost about $20,000,000.

In order to obtain as much water as possible from the Croton river, a number of storage reservoirs were built from time to time on the main river or its affluents, in order to retain the excess of water during periods of flood to feed the river during times of droughts. The reservoirs that have been constructed in the Croton watershed are mentioned in the following tables, showing date put in service and storage capacity in millions of gallons:

STORAGE RESERVOIRS IN THE CROTON WATERSHED.

*Old Croton Lake	1842	.....
Boyd's Corners	1873	2,727
Middle Branch	1878	4,155
East Branch	1891	5,243
Bog Brook	1891	4,400
Titicus	1893	7,617
Carmel or West Branch	1895	10,668
Amawalk	1897	7,086
New Croton	1905	33,815
Cross River	1908	10,823
Croton Falls	1910	15,753
Total		102,387

*Included in New Croton reservoir.

Besides the storage mentioned above, the city obtains an additional quantity of water by drawing down a number of lakes and ponds, which it either owns or controls, which are with storage capacity in millions of gallons:

STORAGE IN LAKES AND PONDS IN THE CROTON WATERSHED.

White Pond	200
Barret's Pond	170
Lake Gleneida	165
Kirk Lake	565
Lake Mahopac	575
Lake Gilead	380
Total	2,055

From the two tables given above it is seen that the total quantity of available storage in the Croton watershed amounts to 104,442,000,000 gallons.

The works which have been described are those of the former city of New York which forms since 1908 the boros of Manhattan and the Bronx of the Greater New York. Each of the boros of Brooklyn, Queens and Richmond has its own water works.

The three aqueducts supplying Manhattan and the Bronx can deliver about 400,000,000 gallons per day. In case of a severe drought the Croton, Bronx and Byram rivers will not yield more on an average than about 300,000,000 gallons a day.

As the two boros mentioned consume, at present, more than 300,000,000 gallons a day, it is evident that some new source of supply must be drawn on. This fact was realized in 1900.

In 1902 a commission of three expert engineers—Professor William H. Burr, Rudolph Hering and John R. Freeman—was appointed to investigate all possible sources from which New York could obtain an additional supply of water.

This commission recommended that a daily supply of 250,000,000 gallons be obtained from the streams in Dutchess county, immediately north of the Croton watershed, and that an additional supply of 250,000,000 gallons be derived from streams in the Catskill mountains.

An act passed by the legislature prevented the city of New York from diverting any water from Dutchess county, and the city had, therefore, to go to the Catskill mountains to obtain its supply.

The necessary works to secure a supply of 500,000,000 gallons per day have been in course of construction since 1905, under the direction of a Board of Water Supply, composed at present of the following three commissioners: Charles Strauss, Charles N. Chadwick and John F. Galvin. J. Waldo Smith is the chief engineer of the board.

The work when completed will consist of an aqueduct 17 feet high by 17½ feet wide, capable of delivering daily 500,000,000 gallons. This water is to be distributed to all of the five boros of Greater New York.

The Catskill Aqueduct, as the new conduit is called, will consist of:

Cut and cover aqueduct	55 miles.
Grade tunnel aqueduct	14 miles.
Pressure tunnel aqueduct	17 miles.
Steel siphon pipes	6 miles.
Total	92 miles.

The aqueduct begins at the Ashokan reservoir on Escords creek, which will have a storage capacity of 130,000,000,000 gallons, and terminates at the city line, at the Hill View Reservoir, which will store 900,000,000 gallons. The Hudson river is crossed by a siphon tunnel, 14 feet in diameter, which was bored thru solid rock about 700 feet below the surface of the river.

To provide for emergencies, the Kensico Reservoir is being constructed on the Bronx river, 30 miles north of the City Hall. It will store 40,000,000,000 gallons.

From the Hill View Reservoir the water will be distributed to the boros thru circular pressure tunnels 15 feet in diameter, which are to be excavated deep below the streets in solid rock. From two terminal shafts in Brooklyn steel and iron pipes will convey the water to the boros of Queens and Richmond. The total length of this distributing system is 34 miles.

The works now in course of construction will cost about $200,000,000. The supply from Esopus creek will only average about 250,000,000 gallons per day. In the future additional reservoirs will be constructed to obtain another daily supply of 250,000,000 gallons from the creeks in the Catskill mountains.

The works briefly mentioned above are of such magnitude and involve so many details that it would require a large volume to describe the Catskill water works adequately.

ORDINANCES REGULATING BILLBOARDS.

ONE of the difficult problems of the workers for the "City Beautiful" is the control of billboards and like structures, which are themselves blots upon the landscape and cut off views which would add much to the pleasure of existence. The city of Chicago passed an ordinance in January, 1907, regulating the construction and maintenance of sign or billboards, which was held void by the courts in 1909, because one section provided that all lands abutting rights-of-way of railroads were exempted from its provisions, "an unjust and unreasonable distinction in favor of the owners of such lands." Each section of the ordinance was passed upon in the opinion prepared for the court by the master in chancery and some were declared valid and others invalid, but the ordinance as a whole was considered invalid, because the elimination of the proviso objected to would extend the application of the ordinance over lands expressly excluded by the city council from the control of the ordinance.

In 1911 the city of Portland, Ore., under the provisions of the initiative, passed a billboard ordinance differing only in a few details from the Chicago ordinance. Upon request of H. E. Plummer, the building inspector, City Attorney Frank S. Grant made a thorough study of the ordinance and expressed his opinion of the provisions of each section, quoting from decisions of Illinois, New York, New Jersey, Kansas, Missouri and Colorado courts on billboard cases, and from many other cases involving validity of restrictive city ordinances.

Following are some of the restrictions which are void, according to the decisions noted or quoted:

One making the inspector of buildings the judge of the character of design or work which will be accepted. It is held that the council must fix the specifications for construction, and to the building inspector can then be delegated the duty of determining whether the billboards are constructed according to the ordinance. Commonwealth v. Maletsky, 203 Mass. 241, on delegation to chief of fire department the power to issue licenses for rag picking buildings on his own rules; Winthorp v. New England Chocolate Co., 180 Mass. 464; Newton v. Belger, 143 Mass. 598, are other cases, in which no regulations or qualifications were set up by the ordinance for the guidance of the city official, and the ordinances were therefore void. Chicago v. Gunning System, 214 Ill. 628, 70 L. R. A. 230, is the case referred to above, and the section making this provision was considered void, because the conditions in various parts of the city differed greatly and so much discretion as to the propriety of proposed structures could not be left to a city employe.

A general provision that all billboards must be made of incombustible material is void, according to the Chicago decision, because this is not necessary in many cases and discriminates against billboards located outside the fire limits. The provision would not be void if restricted to the fire limits or equivalent conditions.

A restriction of size of billboards on buildings without reference to their safe construction is considered void. In People v. Murphy, 195 N. Y. 126, 88 N. E. 17, L. R. A. (N. S.) 735, such restrictions of "sky signs" were declared void, because the restriction was applied to signs or billboards and not to other structures or to ornamentation on buildings, such as flagpoles, balustrades, finials, chimneys, towers, tanks, etc., no distinction being made between parts or appurtenances of the buildings and attachments wholly foreign thereto, such as the billboards under consideration.

The same is asserted of a provision that no sign should be put on a building more than two stories in height, nor on a sloping roof.

Sections limiting height of billboards, without reference to the safety of their construction, are void. Curran Bill Posting and Dist. Co. v. Denver, 47 Colo. 221, 107 Pac. 261, 27 L. R. A. (N. S.) 544, is referred to as a decision directly to this effect. Crawford v. City, 51 Kan. 756, 20 L. R. A. 692, 37 Am. St. Rep. 323, 33 Pac. 476, is a Kansas case, which decides that a regulation requiring billboards to be set back of the lot line is void, police regulations extending to the manner of construction, but not to location upon private property. Passaic v. Paterson Bill Posting, Adv. and Sign Painting Co., 72 N. J. L. 285, 111 Am. St. Rep. 676, 62 Atl. 267, 5 A. & A. Am. Cor. 996, is a similar case, denying the right of the city council to limit position of billboards to ten feet or more from other structures.

A provision making the ordinance retroactive is void. In Whitmier & F. Co. v. Buffalo, 118 Fed. Red. 773, is a decision that "As to billboards erected before the restrictive ordinance under consideration the injunction is continued."

A provision that the consent of a majority of the property owners in the block must be obtained before erecting a billboard is deemed void, because in every state but Illinois power to determine what is a lawful business, not injurious to pub-

lic health or morals, to be carried on in the immediate neighborhood of a citizen, cannot be delegated to him. Decisions on this point regarding ordinances requiring consent of property owners are noted as follows: Re Quong Woo, 13 Fed. 229, ex parte Sing Lee, 95 Cal. 354, 24 L. R. A. 195, 31 Am. St. Rep. 218, 31 Pac. 245, as to location of public laundry; State v. Garibaldi, 44 La. Am. 809, 11 So. 36, regarding establishment of private market; St. Louis v. Howard, 119 Mo. 41, 41 Am. St. Rep. 630, 24 S. W. 770, regarding establishment of slaughter house; Re Kiely, 13 Ont. Rep. 451; St. Louis v. Russell, 116 Mo. 248, 20 L. R. A. 721, 22 S. W. 470 (overruling State ex rel. Russell v. Beathe, 16 Mo. App. 131), regarding establishment of livery stable; the Chicago case above quoted, as to provision requiring consent of property owners to erection of billboard; State v. Omaha, 110 N. W. 680, 8 L. R. A. 978, regarding location of gas tanks; Tilford v. Belknap, 126 Ky. 254, 103 S. W. 289, regarding erection of frame building.

A provision that no fence on property line shall be more than eight feet high is deemed void. Rideant v. Knot, 148 Mass. 368, and Bordeaux v. Green, 22 Mont. 254, are cases in point, the latter allowing a fence 40 feet high; Western Co. v. Knickerbocker, 103 Cal. 111, sustaining one 20 feet high; Metzger v. Hocholin, 107 Wis. 267.

The decisions upholding billboard ordinances were reviewed by Judge White in the Denver case referred to above. In the ordinances declared valid in the cases of Rochester v. West, 164 N. Y. 510, 53 L. R. A. 548, 79 Am. St. Rep. 659, 58 N. E. 673; Gunning System v. Buffalo, 75 App. Div. 31, 77 N. Y. Supp. 987; and Whitmier & F. Co. v. Buffalo, (C. C.) 118 Fed. 773, the height of billboards was limited in Rochester to six feet and in Buffalo to seven feet, unless the consent of the council was first obtained in a manner provided. In re Wilshire, (C. C.) 103 Fed. 620, a Los Angeles ordinance limiting the height of billboards to six feet was upheld, because they "are usually, if not invariably, cheap and flimsy affairs, constructed of wood."

In the St. Louis Gunning Co. v. St. Louis, 137 S. E. 929, the ordinance complained of required a permit for the erection of and repairs to bill and signboards, fees for same, removal of signs existing before the passage of the ordinance, a certain method of construction, height, area, etc., and also fences of a certain height and construction. The court took cognizance of the menaces to public safety and welfare incident to the usual methods of billboard construction and of their inartistic nature in the following words, quoted from the opinion accompanying the decision upholding the ordinance:

"The signboards and billboards upon which this class of advertisements are displayed are constant menaces to the public safety and welfare of the city. They endanger the public health, promote immorality, constitute hiding places and retreats for criminals and all classes of miscreants. They are also inartistic and unsightly.

"The amount of good contained in this class of business is so small in comparison to the great and numerous evils incident thereto, that it has caused me to wonder why some of the courts of this country have seen fit to go so far as they have in holding statutes and ordinances of this class void, which were only designed for the suppression of the business itself."

This decision was made in May, 1911, and is the first which gets away from the strictly business consideration and recognizes the rights of the public to protection of its right to beauty as well as utility in its surroundings. There has always been some way to get around the strictly business demands for location of a certain structure or industry in a neighborhood mainly devoted to fine residences, and this is the first decision which attempts to do the same thing for all classes of people without reference to the amount of money which they may have invested in their business.

Spite fences are altogether possible under some of the decisions quoted above, altho usually such obstructions are eliminated by court order, often not getting beyond the police court. Nearly every opinion from which quotations are made as well as the dissenting opinion of one judge in the St. Louis case, takes a fling at the "aesthetic view," presented in St. Louis by a "civic league or confederation of civic leagues," which "undertakes to condemn structures on the basis of the use to which they are to be put." The dissenting St. Louis judge voices the opinion of the other judges opposing billboard ordinances when he says:

"Such lawful use cannot be stricken down to please the eye. Of course, under the police power the character of the advertising could be scrutinized. Further, the character of the structure as to public safety, health and morals may be regulated, but such are the limits of the police power."

The only material difference between the two opinions in the St. Louis case and between the opinions sustaining and those condemning ordinances controlling the erection and maintenance of billboards is as to how far the police power of the city can be extended. One side apparently would restrict the application of the police power to the insurance of the safety of the structure from overturning or burning, while the other would take

under consideration also the shutting off of light and air, the obstruction of view, the objectionable nature of the advertisements, or of any advertisement whatever, the added dangers from other than fire or overturning to the adjoining property, not the least of which is the difficulty of close police supervision of the area shut off from public view and the resulting possibility of crime and misdemeanor from porch climbing to indecency and violation of health laws.

These seem to the members of the civic leagues to be quite as important as the simple strength of construction; indeed, to be more important, because their neglect affects the comfort and moral well-being of thousands of citizens all the time, while the danger of overturning or of fire affects the life or property of but few for short times and but seldom.

The world does move, and the St. Louis decision may be the first of a series which will bring about the reforms which so many good citizens are striving for.

After criticising the Chicago billboard ordinance and the old Portland ordinance, Mr. Grant presented an ordinance which, he believes, does not contain any of the void or voidable features of those ordinances, and this ordinance was passed by the city council of Portland, and went into effect on April 26, 1912. It reads as follows:

Ordinance No. 23564.

An ordinance licensing and regulating the erection, construction and maintenance of billboards within the corporate limits of the city of Portland, providing a penalty for violations thereof and repealing all ordinances and parts of ordinances in conflict therewith.

The city of Portland does ordain as follows:

Section 1. Within the meaning of this ordinance any structure over four feet in height erected, maintained or used for the purpose of posting advertisements thereon, or painting advertisements or signs thereon, and all such structures having connected therewith any electric sign, shall be held to be a billboard or signboard; provided, however, that electric signs composed only of letters or figures painted and outlined with electric lights and not used in connection with any billboard or signboard, shall not be subject to the provisions of this ordinance.

Sec. 2. No person, firm, co-partnership or corporation shall erect within the city of Portland any billboard or signboard over four feet in height, and as provided for in this ordinance, without first having secured a permit from the building inspector therefor. Said permit shall be granted to the applicant therefor upon payment of a fee of fifty cents and upon furnishing the said building inspector with a drawing and description of construction and location of said billboard or signboard to be constructed. Said description and drawing shall be in conformity to the provisions of this ordinance, and shall be dated, filed and kept by said building inspector in convenient form for reference.

Sec. 3. Every billboard or signboard shall have displayed thereon a name plate, or imprint, designating the name of the person, firm, co-partnership or corporation owning, controlling or maintaining same.

Sec. 4. It shall be unlawful to display on any billboard or signboard any advertisement or advertising matter which is immoral, offensive, improper, indecent, lascivious or obscene.

Sec. 5. For the purposes of this ordinance, billboards and signboards shall be divided into two classes:

First: Billboards or signboards erected upon buildings or other structures.

Second: Billboards or signboards erected upon the ground.

Sec. 6. It shall be unlawful for any person, firm, co-partnership or corporation to erect or maintain within the city of Portland any billboard or signboard which is not constructed in accordance with the following specifications:

Any billboard or signboard erected upon the roof of a building or structure within the fire limits, the surface of which is over three feet in height and not to exceed ten feet in height, shall be attached to a frame work consisting of uprights or posts of angle iron 3-16x1¾ inches in dimensions or of wood completely covered with iron, not less than 2x6 inches in dimensions, set not more than eight feet apart, securely bolted or anchored to the roof of the building or structure with metal fastenings. Said uprights to be securely braced with angle iron braces not less than 3-16x1¾ inches in dimensions of wooden braces completely covered with iron, not less than 2x6 inches in dimensions, not less than one brace to each upright, securely fastened to the top or within three feet of the top of said upright, the other end securely fastened to the roof or fire wall of the building or structure by bolts or metal fastenings. Said braces to be placed at an angle of not more than 60 degrees from the horizontal. There shall be stringers of angle iron not less than 3-16x1¾ inches in dimensions or of wood covered with iron, not less than 2x4 inches in dimensions, running the entire length of the billboard or signboard, securely attached to each post or upright to which the surface of said billboard or signboard shall be attached. There shall not be less than one stringer for each four feet or fraction thereof the surface of said billboard or signboard is in height. The surface of

such billboard or signboard shall be of metal with the exception of wooden strips for stiffening and ornamental wooden molding not to exceed four inches in width, the entire surface to be securely attached to said stringers and framework.

Any billboard or signboard erected upon the roof of a building or structure within the fire limits, the surface of which is greater than ten feet in height and not to exceed twenty feet in height, shall be attached to a framework consisting of uprights or posts of angle iron 3-16x2 inches in dimensions, or of wood completely covered with iron, not less than 4x6 inches in dimensions, set not more than seven feet apart, securely bolted or anchored to the roof of the building or structure with metal fastenings, said uprights to be securely braced with angle iron braces not less than 3-16x2 inches in dimensions, or wooden braces completely covered with iron, not less than 2x6 inches in dimensions; not less than two braces to each upright, one securely fastened to the top or within five feet of the top of said upright, the second brace to be attached at a point not less than ten feet nor more than fifteen feet below the top of the sign. The other ends of said braces are to be securely fastened to the roof or fire wall of the building or structure by bolts or metal fastenings, said braces to be placed at an angle of not more than 60 degrees from the horizontal. There shall be a counterbrace of angle iron not less than 3-16x2 inches in dimensions, or of wood completely covered with iron, at least 2x6 inches in dimensions, securely attached at or within three feet of the bottom of each post or upright and extending upward and securely attached to or near the middle of each brace.

There shall be stringers of angle iron not less than 3-16x2 inches in dimensions, or of wood covered with iron, not less than 2x4 inches in dimensions, running the entire length of the sign, securely attached to each post or upright to which the surface of said billboard or signboard shall be attached.

There shall not be less than one stringer for each four feet or fraction thereof the said surface of said billboard or signboard is in height.

The surface of such billboard or signboard shall be of metal with the exception of wooden strips for stiffening, and ornamental molding not to exceed four inches in width, the entire surface to be securely fastened to said stringers and framework. It being provided that no unsupported length of angle iron taking compression strain shall exceed ten feet in length, and that no wood 2x6 inches in size taking compression strain shall have an unsupported length in the six-inch direction of over sixteen feet, or in the two-inch direction of over nine feet.

Any billboard or signboard erected upon the roof of a building or structure shall be set back from the fire wall of said building or structure a distance of at least three feet, and so as to leave a clear passageway around and in front of same. The bottom of the surface of said billboard or signboard shall be at least four and not to exceed eight feet in the clear above the roof of said building at its nearest point, and so as to leave a clear passageway under the same.

All materials used in the construction of such billboard or signboard shall be of the best quality and attached in such manner as to make a thoroly strong, substantial and workmanlike construction, so as to preclude the possibilities of said billboard or signboard being blown from the building.

The construction of any billboard or signboard erected upon the roof of any building or structure within the fire limits, the surface of which exceeds twenty feet in length, shall be same as that provided for those less than twenty feet in height, except the framework shall be proportionately increased in strength.

Sec. 7. Any billboard or signboard erected upon the roof of any building outside of the fire limits shall be constructed in the same manner as those within the fire limits, with the exception that the framework and surface may be built of wood.

Sec. 8. Any billboard or signboard, the surface of which is over seven feet and not to exceed ten feet in height, built upon the surface of the ground within the fire limits, shall be securely attached to a framework consisting of wooden posts or uprights not less than 4x4 inches in dimensions, not more than ten feet apart and not less than three feet in the ground. Said posts shall be braced by wooden braces not less than 2x6 inches in dimensions, one brace to each post, said brace to be securely attached at the top or within three feet of the top of said post; the other end securely attached to an anchor post of not less than 4x6 inches in dimensions, set not less than four feet in the ground, well tamped. Said braces shall be placed at an angle of not more than 45 degrees from the horizontal. There shall be wooden stringers not less than 2x4 inches in dimensions, running the entire length of said billboard or signboard, securely attached to the posts or uprights, to which shall be attached the surface of said billboard or signboard. There shall not be less than one stringer for each four feet or fraction thereof the surface of said billboard or signboard is in height.

Sec. 9. Any billboard or signboard, the surface of which is over ten feet and not to exceed twenty feet in height, built upon the surface of the ground within the

fire limits, shall be securely attached to a framework consisting of wooden posts or uprights not less than 4x6 inches in dimensions, not more than eight feet apart and set not less than four feet in the ground. Said posts shall be braced by wooden braces not less than 2x6 inches in dimensions, not less than two braces to each post, one brace to be securely attached at the top or within five feet of the top of said post, the second brace not less than eight feet and not more than twelve feet from the top of said post. The other ends of said braces are to be securely attached to anchor posts of not less than 6x8 inches in dimensions, set not less than five feet in the ground, well tamped. Said braces shall be placed at an angle of not more than 60 degrees from the horizontal. There shall be wooden stringers not less than 2x4 inches in dimensions running the entire length of the billboard or signboard, securely attached to the posts, to which shall be attached the surface of said billboard or signboard.

There shall not be less than one stringer for each four feet or fraction thereof the surface of said billboard or signboard is in height.

The construction of any billboard or signboard built upon the surface of the ground within the fire limits, the surface of which exceeds twenty feet in height, shall be the same as that provided for those less than twenty feet in height, except the framework shall be proportionately increased in strength.

Sec. 10. The surface of each billboard or signboard erected within the fire limits shall be of iron or some other non-combustible material. All materials and fastenings used shall be only of the best quality and attached in such a manner as to make a thoroly strong, substantial and workmanlike structure, such as will preclude possibility of said billboard or signboard from being blown down; provided that where natural conditions are such that it is impossible to follow strictly the specifications herein set out, all billboards or signboards shall be braced in some other equally strong, durable, substantial and workmanlike manner.

Sec. 11. It shall be unlawful for any person, firm, co-partnership or corporation to permit any unsanitary condition to exist under or around any billboard or signboard, or to permit waste paper, refuse, garbage or rubbish to accumulate under or about any billboard or signboard, and all billboards or signboards shall at all times be kept in a clean and sanitary condition.

Sec. 12. Any billboard or signboard over seven feet in height, erected upon the surface of the ground outside of the fire limits, shall be constructed and maintained in the same manner as those constructed on the surface of the ground within the fire limits, with the exception that the same may be of wood.

Sec. 14. Any person, firm, co-partnership or corporation owning or operating, maintaining or in charge, possession or control of any billboard or signboard within the city of Portland, who shall neglect or refuse to comply with the provisions of this ordinance or who erects, constructs or maintains any billboard or signboard that does not comply with the provisions of this ordinance, shall, upon conviction thereof, before the municipal court, be fined not less than $25, nor more than $200 for each offense, and each day on which any such person, firm, co-partnership or corporation shall permit or allow any billboard or signboard owned or operated, maintained or controlled by them to be erected, constructed or maintained in violation of any of the provisions of this ordinance, shall constitute a separate and distinct offense.

It may be suggested here that two practical points are omitted in this ordinance which are very important from the moral and sanitary points of view. Theoretically, they are doubtless left to the tender mercies of the policemen, but practically, they are essential to the safety of the public

First, the bottom of the signboard or billboard should be two or three feet above the surface of the ground, at least three feet, if weeds and grass are permitted to grow about them. Policemen cannot keep constant watch of the rear of billboards, especially if at a distance from the street line, and the ground under them must be left sufficiently open so that the public can see thru. This provision will also make it easier to keep the vicinity of the billboards, especially the rear, free from deposits of rubbish and filth. Second, the structure should be located fifteen feet or more from any building. The sneakthief or burglar finds a closely built billboard a convenient ladder to an unprotected upper story, and the city has no business to permit the increase of the property owners' hazard needlessly.

The judges whose decisions are noted above would possibly consider these unwarranted restrictions of the use of private property, but it must be remembered that the billboard is not a building under occupation, but is set out and left unwatched and unoccupied and is usually located on ground leased for the purpose by a company not interested in the welfare of the property or the neighborhood. It would seem that the city has the right to regulate the construction and use of such structures so as not to increase the burdens of the adjacent property owners and of the passersby, not to mention its

duty to protect the moral well-being of the community.

A few ordinances and court decisions have been published in MUNICIPAL ENGINEERING. The New York Murphy case, above referred to, will be found in vol. xxxvii, p. 264. In the case of C. J. Sullivan Adv. Co. v. City of New York, 113 N. Y. S. 893, quoted in vol. xxxvi, p. 387, it was decided that the city had no right to permit a billboard on the outside of a shed constructed over a sidewalk, under an ordinance requiring that signs, billboards, etc., shall be erected entirely within the building line. The Buffalo ordinance above referred to is briefly described in vol. xxiii, p. 197, and an extract from the decision upholding it is given on p. 398.

An extract from a decision in Galland v. City of Wilkesbarre, Pa., Sup. Ct., vol. xxxviii, p. 52, allows police regulation of billboards within legitimate bounds from falling on passersby, endangering property from fire, smelling badly, spreading disease or offending moral instincts of mayor and police.

In Fifth Ave. Coach Co. v. City of New York, 86 N. E. 824, quoted in vol. xxxvii, p. 43, an ordinance prohibiting advertising wagons solely for that purpose is held valid, altho the ordinance permits thereon the usual business notices of the operators of the wagons.

In State v. Inhabitants of City of Trenton, 53 Atl. Rep. (N. J.) 202, quoted in vol. xxiv, p. 39, the right to restrict the operation of an ordinance regulating signs to certain streets or city areas is upheld.

Some of the decisions quoted in an article on "Power of State to Control Use of Property by Sanitary Regulations," vol. xli, p. 298, may be of interest in this connection.

The provisions of ordinances of Cleveland, Ohio, regulating billboards and signs on streets or on buildings on the street lines, quoted in vol. xlii, p. 249, are more strict than any which have been mentioned above, but do not cover such structures entirely on private property.

GAS FOR HEAT AND POWER.*

By E. B. Rosa, U. S. Bureau of Standards, Washington, D. C.

THE use of gas for heat and power has rapidly increased in recent years, partly due to a reduction in the price of gas and to improvement in the service rendered by gas companies, and partly to the improvement of gas appliances in the direction of greater convenience and efficiency, and to the invention of new appliances for the accomplishment of many results in new ways. With more than 1,300 gas companies in the country, with a combined capital of $1,000,000,000 and annual sales of $200,000,000, it is one of the most important of the industries.

Coal Gas. The first recorded suggestion of the use of gas for fuel was in the patent (taken out in England in 1805) by F. A. Winsor for a process of "extracting inflammable air" from coal. The product was to be applied to heating as well as to lighting; but, in spite of his great enthusiasm, Winsor was not successful in bringing about the utilization of gas for fuel, and little was done along this line until about 1825, when the first gas cooker was invented. From that time until about 1880 development was very slow.

One important invention, however, was that of Delbruck, who placed one tube inside another, using one for the gas and the other for the passage of the air, using the two at the point of ignition.

What are usually called Bunsen burners, in connection with gas stoves, are a modification of Bunsen burners invented by Thomas Fletcher, of England. The true Bunsen consists simply of the familiar open tube of the laboratory, with the gas nozzle and air ports at the base. Fletcher was the first to use a cap to diffuse the flame and reduce its liability to flash back.

The last thirty years have witnessed a wonderful development of every kind of heating appliance, and the most modern gas lighting units making use of the gas for heating solid materials to incandescence instead of deriving the light from the luminosity of the flame itself.

Acetylene Gas. Although acetylene gas was discovered in 1836, it was not until 1892 that its commercial development was made possible by Willson, who discovered a method of producing calcium carbide in large quantities. The application of acetylene to heating and power has been very recent indeed, and the use of acet-

*From a lecture before the Franklin Institute.

ylene and oxygen in the blow pipe has produced almost the highest temperature known to chemistry—a temperature approximating that of the electric arc, probably above 5,000 degrees F. Thru this means welding has been successfully accomplished and several other important industrial applications have been found. Large steel bridge girders can thus be cut apart with ease. There seems to be a great field open for the oxy-acetylene flame.

Natural Gas. The first use of natural gas in this country was probably in Fredonia, N. Y. (1821), and before long it was being used in rare instances for heating purposes. In 1859, Drake drilled the first oil well, and, as natural gas was found in abundance, its use was greatly increased. At first it was only used near the wells, but from time to time some enterprising individuals would run pipes from nearby wells to their homes and villages. At first it was used in the coal or wood stoves for cooking and heating, and at the wells for power, by piping it directly to the cylinders of steam engines and using its expansive force as a substitute for steam. The waste of gas for many years was very great, no interest being taken in making economical appliances, or even in turning the gas off when not wanted. The first company formed exclusively for the distribution of natural gas was in 1872 in Titusville, Pa., since which time its use has become quite extended.

As a fuel, natural gas is burned in almost exactly the same way and with almost the same appliances as manufactured gas. It may be used in the ordinary gas range, hot plate, water heater or other gas burning appliances, the only change necessary being that, because of the higher pressure, the gas orifices should be smaller, and because of the higher heating value less gas is necessary to produce the same results. Furthermore, the application of natural gas to coal burning installations of all kinds is very simple and, as a rule, very efficient.

The growth of the business in the last thirty years is shown by these figures from the United States Geological Survey, representing the approximate value of natural gas produced in the United States:

Year.	Value.
1882	$ 215,000
1892	14,870,714
1902	30,867,863
1909	63,206,941

Producer Gas. Producer gas, a gas made from cheap fuels, using oxygen from the air to produce carbon monoxide, has come into prominence within the last twelve years. Altho only a few scattered installations are reported as having been made in the United States prior to 1900, there are now probably 200 or more plants together having an output of over 50,000 horsepower.

The two principal types of gas producers are the suction plant, used for small units below 300 horsepower capacity, and the pressure plant used for larger outputs. The suction plant receives its name from the fact that the engine develops its charge of gas in the producer by the means of its own suction stroke. The pressure plant develops its gas under a slight pressure due to the introduction of an air and steam blast, and the gas is stored in a holder until it is required by the engine.

In Europe producer gas has been applied much more generally than in this country, but it is fast working its way into the industries here, such as glass furnaces, brick, pottery and terra cotta kilns, lime and cement kilns, sugar house char kilns, silver chlorination and ore roasting furnaces, etc. Altho its use is accompanied by some dangers and disadvantages, the fact that it is the cheapest gas made per unit of heat and contains more of the energy originally in the coal than any other, and that it is possible to use very pure fuel in its production, make it a very economical gas when properly applied.

Conditions for Good Combustion. One of the principal points to consider in the construction of heating appliances is the combustion of the gas. Efficiency, maintenance and many other important items are largely dependent on this feature. Some of the conditions for good combustion are:

(a) Complete and equal combustion of the gas must be had over every part of the burner and from every opening in the burner.

(b) Good mixing of air and gas, and equal proportion of primary air in all parts of the burner are essential.

(c) There must be plenty of secondary air in the proximity of the burners, so that the flames will not be smothered, and good draft thru the appliance to carry away the products of combustion.

(d) Flames should not impinge on cold surfaces in such a way as to cause incomplete combustion, and so waste the heat and perhaps produce carbon monoxide.

(e) In those appliances where an adjustable air shutter is used, this shutter should be easily adjustable, and yet should remain as adjusted. In those appliances that have a fixed air supply, the spuds should be readily accessible. Each different form of appliance offers problems of its own, but the observance of these general conditions is important.

Development of Gas Cooking. In the

patent taken out by Mr. Winsor in 1805 for the manufacture of coal gas, we find the first recorded suggestion of the use of gas for cooking; but the actual utilization of gas for cooking was much later. Our earliest knowledge of a gas stove is to be obtained from a magazine of the year 1825, which described it as a piece of "gas apparatus for cooking by inclosing the circle of gas flames with its reflecting cone in a cylinder of tin, from the top of which a pipe takes off the burnt air." A drawing of the burner was also given and the writer adds: "A hot plate has been heated by the gas, and it has also been employed to heat an oven. * * * It cannot be expected to succeed, however, except in the hands of persons whose scientific knowledge enables them to employ it with safety."

For a number of years there seems to have been little done in the way of actual trial, altho the geniuses of the time were thinking about it and taking out patents. It is unlikely that we shall ever know who was the first user of gas for cooking; all we know definitely about the subject being that James Sharp, of Northampton, England, demonstrated the availability of gas cooking in his own house about 1830 or 1832, and a year or two later John Barlow, of Islington, London, had an apparatus for roasting, boiling and steaming in the kitchen of his house. This consisted of a tin oven, around the four sides of which, near the bottom, ran a gas pipe, fitted with small burners about an inch apart; on a stand alongside the oven were two or three rings of piping with burners, and over these were placed the boilers and saucepans. After this, inventions for cooking by gas became more numerous, altho the gas range at first gained very slowly in popularity.

In 1850 James Sharp, then of Southampton, delivered a lecture entitled "Gastronomy," in the course of which he roasted before the audience 34 pounds of beef, 15 pounds of mutton and 12 pounds of pork, and boiled and steamed 24 pounds of mutton and codfish, 4 fowls, 8 plum puddings, vegetables, etc., and baked pies and tarts, the whole being done with the expenditure of 156 feet of gas.

In the following year (1851) Alexander Graham, a well-known hotel proprietor of Glasgow, exhibited in the great exposition in London a gas cooking oven, which was fitted with luminous jets inside. Mr. Graham made and sold a limited number of cookers for hotels and restaurants, but so far the use of ovens for domestic purposes was practically unknown.

A stove used in Philadelphia prior to 1860 is still in existence and formed part of the exhibition in connection with the gas centenary. It has a peculiar boiling burner which consists of a piece of one-eighth-inch pipe, bent upwards into a sheet iron truncated cone, containing a perforated baffleplate of the same material. The upper end of the cone contained a fine wire screen covered with about one-half inch of fine gravel.

From this time on until about 1880 the history of the use of gas for cooking was an exceedingly slow development. In 1860 the Cincinnati Gazette said: "At the present about 100 families are cooking with different kinds of gas stoves."

The development has taken a faster pace in recent years and thus has brought us to the present state of efficiency and convenience. The gas cooking range of today is distinguished by the following features: The flow of the hot products of combustion from the oven burners is so directed that the food is evenly cooked top and bottom in any part of the oven; air space insulation of the oven walls prevents the loss by radiation of an undue quantity of heat; adjustable air mixers on all burners permit of the complete elimination of soot; the boiling burners are so set that the placing of vessels over them does not smother the flames, nor cause incomplete combustion; the boiling burners and their fixtures are easily removed by the cook for purposes of cleaning, are put in place again with equal ease, and all details are aimed to combine efficiency and convenience.

Tests of the relative heat efficiency of gas ranges have been made, but such tests have not been sufficiently standardized so that numerical statements can easily be made. Further tests are desirable, and if greater attention is given to the question of efficiency and economy, it is probable that considerable further improvement will be made by manufacturers.

Gas Water Heating. About 1825 Robert Hicks took out a patent in England for "Heating water in baths by means of burning spirits of turpentine or carbonetted hydrogen gas in chambers, in the bath, or in tubes passing thru or under them."

Up to about 1890 there were really no convenient and economical water heaters. Since then the instantaneous hot water heater has been developed, and this has greatly augmented the use of gas ranges, the one being a very important adjunct to the other. Gas water heating is one of the most important of the domestic uses of gas, and it is very desirable that water heaters be tested systematically and the results of tests made public for the information of users.

Gas Room Heating. About the year 1833 a patent was granted to one Richard Barnes for heating buildings by the combustion of gas or oil, applying the flame either externally to tubes or chambers

thru which currents of air were passing, or else placing the flame inside the tubes or chambers.

Peckston in his "Practical Treatise on the Manufacture of Gas," published in 1841, says: "Coal gas has of late years been applied to the heating of churches, chapels, shops, counting houses, etc., * * * and has been found to answer the purpose intended." The stove described very closely resembled the cooking stove of 1825, except that it was provided at the top with a register instead of the flue.

A form of stove now very popular in England under the name of the "Gas Fire," consisting of lumps of incombustible material heated to a greater or less degree of incandescence by gas burners, so as to resemble a coal fire, was patented by Edwards in 1849. Seven years later Nathan Defries was granted a patent for a similar device, the "argillaceous material" specified having fastened upon it fibers of asbestos, which, upon lighting the gas, became incandescent. This was followed three years later by a patent granted to Reece for a stove in which the asbestos was the main feature.

In spite of the limited use of gas for fuel, a company called "The Gas Fire Company" was incorporated in England in 1852. This seems to be the forerunner of the many ill-fated attempts to do a purely fuel business by artificial gas. Room heating is now one of the common uses of illuminating gas.

The Use of Gas for Industrial Purposes. In 1806 Josiah Pemberton exhibited various forms of gas lights in front of his factory at Birmingham. He was the first to construct a gas stove, using it for the soldering required in his button factory.

About 1840 a Scotch manufacturer by the name of Mackintosh made several tons of "cemented" steel by submitting iron at a dull red heat to the action of lighting gas. The carbon for the steel was derived from the gas.

In 1857 a patent was granted for the heating of irons for laundry work by means of gas, and in 1859 a soldering apparatus for continuous soldering by means of gas was described in the *Technical Press.* This included the use of a blast worked by a foot bellows.

In an advertisement of Elsner, of Berlin (July, 1859), it was pointed out that there was scarcely a brand of domestic work, of industry or of business for which a gas cooking or heating apparatus could not be recommended. Thus it is evident that the use of gas for industrial purposes is not of recent origin, and that it has not been brought about thru a falling off in the use of gas for lighting, due to the increased use of electricity.

At the Paris Exposition (1867) there was exhibited singeing apparatus for use in wool works, dye works and bleaching works. Jewelers were also using gas. Plants for chemical and metallurgical purposes and laboratory ovens were also shown.

About thirty years ago what seems a curious method of using gas was considerably in favor. This was its use under boilers for generation of steam for engines up to about two horsepower. At the Royal Agricultural Societies Exhibition, held in 1879, several forms of such boilers were exhibited.

In 1879 the South Shields Gas Company, an English concern, gave an exhibition of over 300 appliances, in which gas was to be used for other purposes than lighting.

Today there are about 1,000 practical applications of gas in the industries, and a conservative estimate places the proportion of gas sold for fuel at one-half the total sales.

Air Under Pressure vs. Gas Under Pressure in Industrial Appliances. The subject of air and gas under pressure is one that is receiving considerable attention at the present time, altho the field has not been as extensively explored as the others that have been described.

In England and on the continent there are a number of companies now operating to furnish gas at high pressure for private establishments as well as for the public street lamps. The result is that in Europe there has been more done with the gas under pressure than in America, while, on the other hand, America has probably made more use of the air blast with low-pressure gas: "The disadvantage of the latter for furnace heating is that the efficiency depends upon the two pressures remaining constant. Experience shows that, under working conditions, it is too much to expect that these will remain constant; but the main defect in air-blast burners up to quite recently has been that they were badly designed, their mixing arrangements being inadequate. Such gas burners as those recently designed, which do away with secondary air and improve the mixing of the air and gas, are a great advance on previous designs.

"High-pressure gas should have a great field before it in the industrial world. It can be applied to all heating processes with efficiencies reaching in some cases at least 90 per cent. Its chief charm is its cleanliness and its simplicity; and in by far the majority of cases it compares well in cost with solid fuel."

List of the Processes in Which Industrial Appliances Are Used. Some of the processes in which gas has been used in the industries are as follows:

(1) Hardening, tempering and anneal-

ing of steel, and the heating of automatic heating machines.

(2) The melting of base and precious metals.

(3) Forging and drop forging.

(4) Welding, brazing, soldering and rivet heating.

(5) Developing power and generating steam.

(6) Boiling liquids and melting of solids.

(7) Tire heating and the heating of mangles and steel rolls.

(8) Heating japaning and embroidery ovens.

(9) Air tempering.

(10) Singeing of cloth.

(11) Heating branding irons.

(12) Firing china.

(13) Melting barium chloride and cyanide of potassium for hardening steels.

(14) Embossing and stamping presses.

(15) Heating muffle furnaces and assay work and reducing sweeps.

(16) Heating oil tempering furnaces.

(17) Pressing irons, stoves and machines.

(18) Heating searing irons.

(19) Matrix drying in printing.

(20) Roasting coffee and nuts and popping corn.

(21) Sterlizing and pasteurizing.

These are only a few of the many processes that might be mentioned, but they are typical as showing the wide variety of applications of illuminating gas.

Development of the Gas Engine. The gas engine really dates from the year 1791, when John Barber patented an engine driven by gas obtained by heating wood, coal, oil or other substance in a retort. After the gases had been cooled they passed thru a pump, in which they were mixed with air, to an "exploder." At the orifice of this exploder the gas was lighted and issued in a continuous stream of flame against the vanes of a paddle wheel. This was not only the first gas engine, but was the first gas turbine.

In 1794 Robert Street designed a pump driven by the explosion of turpentine vapor below the motor piston. In 1801 Philippe Lebon took out a patent for an engine to give alternate explosions on each side of the piston. Samuel Brown, in 1823, designed a motor to operate by atmospheric pressure in which he used an explosive gas flame to expel the air from the chamber.

In 1823, L. W. Wright patented his double-acting, vertical engine combined with a governor to regulate the speed. In 1838 William Barnet suggested the compression system of gas motor. This experimental period of gas engine research may be said to have lasted for 70 years: 1791-1860. In the latter year, Lenoir, of Paris, produced the first practical gas engine to work rapidly and silently, with electric ignition by jump-spark. In the years that have followed, improvement after improvement has been made until the amount of coal gas necessary to develop ignition horse power has been reduced from 100 cubic feet to 14, and even 12, cubic feet per hour. Only the principal steps in the development can be mentioned.

In 1861 Million proposed compression and the use of a compression or combustion chamber. In 1862, Beau de Rochas took out a descriptive patent of the compression, four-stroke cycle now known as the Otto.

Otto and Langen exhibited their free-piston, atmospheric engine at Paris, in 1867, and in 1876 Dr. Otto brought out his famous engine with the Beau de Rochas cycle.

In 1878 and 1879 Mr. James Robson, and in 1882 Mr. Dugald Clerk, patented two-cycle engines. In 1884 Atkinson brought out a "differential" type with the strokes of the cycle of different lengths.

In 1890, when the Otto patent expired, many firms who had been making gas engines upon other lines brought out new designs, all working on the Beau de Rochas cycle. This gave a great impetus to the sale of gas engines. With the close of the century came the utilization of producer gas for power purposes; the manufacture of large-sized units, over 600-horse power, by John Cockerill Company, in Belgium, and by Crossley and the Premier engine in England; the design of the Westinghouse throttling governor, and the Sargeant engine, with cut-off governing, the rise of the natural gas engine in large units, and the double-acting gas engine with compression in America.

The two great classes of gas engines today are: (1) The four-cycle or "Otto" type; and (2), the two-cycle or "Brayton" type. The former, called also the internal combustion type, with heating at constant volume, has only one working stroke in four, the four strokes being: Charging, compressing, firing, exhausting. The two-cycle type, with heating at constant pressure, usually has two cylinders, one a compressing pump and the other the working cylinder. A third type of engine which should be mentioned is the cycle with heating at constant temperature or Carnot cycle. The nearest actual approach to this cycle using gas is the Diesel engine.

I am indebted to the Chairman of the Committee on Gas Appliances, American Gas Institute, for most of the material contained in the above sketch of the history of gas appliances.

REMODELING PARK SYSTEM OF LOS ANGELES.

By Burt A. Heinly, Los Angeles, Cal.

LOS ANGELES, in the van of most American cities in all that tends to municipal progressiveness, until two years ago was hindermost in all that went for civic beautification. This city by the western sea in little more than a decade has grown from a well-to-do town of 100,000 souls to the metropolis of the southwest, with a population of more than 400,000. The increase brought great need of all the absolute necessities of the modern city, i. e., sewers, water works, street paving and cleaning, etc., etc. In addition Los Angeles has nearly reached the limit of her bonding power in building a water works system at a cost of $24,500,000, erecting hydro-electric power plants costing $3,500,000, and building a municipal harbor at an expense of $10,000,000.

Another reason for the dilatory position of Los Angeles was that nature, in climate and soil, has been most lavish in her gifts. Now, no municipality in the country has a greater need of parks. In the eastern states a park is really usable for only about five months in the year, but in southern California the parks winter and summer are breathing spaces constantly in service. Los Angeles is essentially a tourist city. And two years ago Los Angeles awakened to the fact that she had the poorest park system of any first-class city in the United States, and that it behooved her to busy herself with her parks and streets.

The plans as they have been mapped out and partially undertaken provide for a system of boulevards and city highways which will bind together twenty-two parks embracing 3,850 acres of rich land already planted to trees and flowers and watered by ample lakes and streams. The total length of the boulevards will be nearly 100 miles, and these will branch in every direction from the Plaza, or center of the city.

Los Angeles has set about her task in the right way, and when I have finished I feel certain that more than one idea which the city has developed for her improvement and profit, as here set forth, will be found equally serviceable by other municipalities.

In the first place a new park board was placed in office. The appointments were not handed around on a silver platter. The commission was selected with the greatest care. Charles Silent, the president, is a man whose hobby is outdoor gardens, and he is the owner of an estate that is one of the show-places of southern California.

H. W. O'Melveny, a lawyer, has given many years of attention and study to the growing of plants under glass.

J. B. Lippincott, already in the employ of the city as assistant chief engineer of the Los Angeles Aqueduct, is a man who, in the pursuit of his calling, has combined the love of nature with it.

These three men, serving without pay and dependent upon the city council for appropriations to carry on their work, were given a free hand by the mayor and told with western frankness "to pitch in."

Here were the assets of the new board: A perfect climate, with a growing season of 365 days in the year, in which most of the trees, shrubs, flowers and vines of the temperate, semi-tropic and tropical zones flourish as the green bay tree; a soil of bountiful richness; and a topography of plain, hill and dell that changes mile for mile, and in its diverse aspects lends itself admirably to the great scheme of beautification that has been mapped out.

The commission found that it has under its care twenty-two parks, ranging from nine-hundredths of an acre to 3,015 acres, and with an aggregate area of 3,850.99 acres. Absolutely nothing had been done to bind these breathing spots together in order to form a complex whole, nor had plans been made to this end. The parks themselves were a repetition of each other. If you saw one you saw them all. At the forcing gardens the shrubs, bulbs and annuals were divided up so that yearly each park received its proportional allotment. For six or eight weeks beds set down in the midst of green lawns were a riot of bright colors; after that black patches of ground showed where flowers had been. Trees had been planted without regard to their order or kind, and ten grew where one should have grown.

The park system had been cared for by a secretary, a superintendent, 19 foremen and 75 day laborers. The department had no maps of the property it managed, and its business was transacted from a single desk in one of the public rooms of the City Hall.

Now the new commissioners had a very well conceived idea that flower gardens stuck in the midst of a green lawn and overhung by matted trees did not necessarily make a beautiful park, or in fact any park at all. They thought it foolish to plant hundreds of thousands of annuals of kinds which nearly every citizen might grow in his own garden and develop more perfect specimens thru individual care than could the park forces. They believed that a park as a cool, pleasant

place to rest could be made more inviting with a broad green lawn properly shaded than an area of flower beds surrounded by wire chicken fence. And they did not believe very thoroly in "Keep Off the Grass" signs.

Fortunately the board found a park superintendent who had a similar conception of natural beauty. Mr. Frank Sherer, educated for his work by the English government at the Royal Botanical Gardens of Edinburgh, Scotland, and with years of training in America, was the man selected to be in charge of operations.

For the first eighteen months the work was largely in undoing things that had been done incorrectly. Assaults were made in all the parks upon the excessive tree growth. There was a general cleaning up, and this is still going on, the usable wood being sawed into stove lengths, corded and sold.

All this was done with a scientific knowledge of the end desired. Where trees were cut down, it was to give other more vigorous trees an opportunity to grow; where they were pruned, it was to direct the growth in the right direction. This was accomplished under the supervision of a forester from the government service. Trees that were in a process of decay, or dying thru injury, and which it was desired to preserve, were placed in the care of a tree surgeon. In the two years interval this weeding out and corrective process has made a striking improvement in all the parks. In Los Angeles great things are possible with vegetable life in a comparatively short time. What it requires nature seven years to accomplish in the east is brought about in southern California within two years.

Lawn areas wherever possible were increased and old lawns were refertilized. In this semi-arid region, sprinkling must be done nearly every day in the year, and fertilizer must be applied frequently. This had not been done, or, if so, with little knowledge of proper methods. In Central Square a five-acre tract in the heart of the city, indeed, it was necessary to remove the old sod and top-soil, replace the removed material with new soil and replant.

REMODELING THE PARKS OF LOS ANGELES.
A Vista in East Lake Park.

Central Square, in fact, was an object lesson. With great possibilities as a beautiful public square frequented by thousands, it had come to the point that women shunned passing thru it by day and men gave it a wide berth by night. A disfiguring grandstand enclosing a convenience station marked its center, and from this point gravel paths radiated. The grandstand has been supplanted by an electric fountain banked with shrubbery and set in the center of a semi-Spanish court, which is shut off from the lawn by a high cement curb that serves as a continuous seat around the enclosure.

The rambling gravel paths have given place to broad diagonal walks of brick set in concrete and lighted at night by ornamental electroliers. A concrete curb with balustrade entrances was then built entirely around the square. A modern convenience station was added at a cost of $10,800. Many trees were cut out; others were added, so that to-day this park is one of the most beautiful of its kind in America. The total expenditure for the remodeling of the park was $33,000, and eighteen months were required for the completion of the work.

The alterations, particularly the pruning of the rank sylvan growth, were not made without some protest from the public. To many good citizens it seemed like desecration, and, after all, everything in the park was a sort of landmark. Civic agitation of six months ago has to-day given place to civic pride in the reformation. But the commissioners learned a valuable lesson. They learned the value of publicity. To-day the board takes the public into its fullest confidence —tells what it is doing, what it wants to do, why, and what will be the cost. As an instance: Mr. Citizen thought a brick walk through Central Square was out of date and in every way inferior to concrete until it was explained to him that the city had used vitrified brick imbedded in concrete at an additional expense over the usual concrete squares in order to harken back to the old Spanish days of the puebla; that it was all a carefully worked-out design.

"Why, of course," said Mr. Citizen, and forthwith told his neighbor what a happy conception it was to bring back the memories of the days when old Spain ruled over the land.

I would make this one of the strongest suggestions to engineers, park boards and officials striving to beautify their cities. Take the public into your confidence, explain your plans, make them see that the improvement should have been made years ago. A thing is too often deemed extravagant or expensive or unnecessary only because its use or its beauty is not fully understood. To many, the details of a picture must be pointed out before the canvas can be appreciated.

REMODELING THE PARKS OF LOS ANGELES.
A Side Hill in Hollenbeck Park.

With the same desire for assistance and support from the public, the park board secured the co-operation of the Men's City Club and the Women's City Club (California is equal suffrage), two of the largest, most influential and militant civic organizations in Los Angeles. These clubs appointed a joint committee, which works in conjunction with the park board for certain well-defined improvements. Illustrated lectures are given by those identified with the park movement, and in every way the effort is made to create and hold popular enthusiasm in the work planned or under way.

While the cleaning up of the parks was in progress an efficient organization was being developed. An engineering corps was formed and began the mapping of all the parks. Detail surveys were made, showing the lawn areas, shrubbery, trees, flowers, walks, buildings and lakes. With this completed, each foreman was called in and asked just how much trimming, planting, sweeping and sprinkling could be done by an average man in an eight-hour day. Following this, the park superintendent interviewed the jobbing gardeners along the same line.

From all the data collected it was found that an average man could care for 3 acres of flat lawn or 2 acres of hill lawn; or 3 acres of flowers or 2 acres of walks or playgrounds; or 1.25 acres of flowers or 5 acres of shrubbery. In other words, a unit system of work was made for the entire park area, and was then applied to each park as it was shown topographically on the plats prepared by the engineering corps. For example: The number of men at Eastlake Park was 12 before the unit system was investigated. But the unit system showed that 9 men should be able to do the work. Three men were weeded out, and this weeding out process was followed in every park in the city where there was found to be need for it. Indeed, it demonstrated that in some instances men were doing much more than the average man was expected to do, but were receiving the average man's pay. In these cases wages went up forthwith. In place of paying a flat rate of $2.50 per day, a minimum wage of $2 for eight hours was adopted, the men being paid from that amount up to $3.50 as they were able to demonstrate their value. The result here is that labor has an incentive to do its best. Again, politics has nothing to do with a man procuring employment or retaining it. He remains with the department only so long as he is able to demonstrate his willingness and efficiency.

REMODELING THE PARKS OF LOS ANGELES.
Mocohuenga Canon in Griffith Park.

The bonus system of payment had been found to work with great success in the construction of the Los Angeles Aqueduct. The same plan was therefore adopted in the care of the parks. The amount of work done, the general appearance and the economies pursued all go to form the basis for bonus payment. Every three months the park board makes an inspection and votes upon the best park showing. To the park receiving a majority vote a bonus of $5 is paid to each man who has been employed therein for thirty days or over. The park foreman, moreover, receives commendation thru the

press. The result is that there is a great rivalry for excellence in all of the twenty-two parks.

The department then advertised that it would undertake to train 20 or 30 young men in the park business; that these boys would be accepted as "apprentices" at the rate of $2 per day, and would be advanced as they demonstrated their efficiency. Double that number applied. To-day Los Angeles is training her own foremen and superintendents. Mr. Shearer watches his men for improvement as he watches the development of a rare plant, and for the ambitious man advancement is certain.

ing here will ultimately amount to $8,000 or $9,000 annually. I have not here the space to elaborate upon the method, but the details are obtainable from the park department.

As fertilization is constantly necessary, so is the need of irrigation. It was found that the services of many men were required to do nothing else than hold a hose. When Central Park was remodeled the 5 acres was gridironed with water mains, to which were attached standpipes that ended in sprinkler heads set flush with the ground, so as not to interfere with mowing and raking. To-day the whole area is sprinkled by one man in

REMODELING THE PARKS OF LOS ANGELES.
Central Park After Improvement.

In three ways besides that of the unit system of work were large economies thought out and practiced. The use of fertilizer is constant thruout the year. It is one of the chief items of monthly expense, amounting to from $15,000 to $18,000 per year under the old system of purchase. A small municipal fertilizer plant was installed at the park stables, where the horse droppings and park cuttings were given chemical treatment. The result was a far better grade of common fertilizer than could be purchased and at about one-third the expense. Two other plants much larger in size are being erected in parts of the city where large numbers of horses are stabled. The saving

two hours where formerly it required two men eight hours to do the work; the daily saving being $3.50, which in a year amounts to $1,277.50. The system is more expensive to install than the usual hose system, but the saving in labor amounts to more than 80 per cent. This system is being extended to other parks as fast as money is available for the purpose. At Exposition Park 39 acres of lawn are now being placed under this system.

The third saving was accomplished in the establishment of a store and purchasing department. Formerly everything was purchased by the single piece as needed. To-day all labor-saving tools and equipment, stock, material and supplies

are bought in quantity ranging from the dozen to the carload. When a thing is needed it is delivered on the work within a couple of hours—there is not the delay of a week to ten days in getting a requisition thru the council for it. The saving here amounted to 33 1-3 per cent.

In a preceding paragraph reference was made to the fact that all the parks where any development had been carried on previously were similar in appearance. To overcome this defect will, of course, require years of planning and development, but already a most encouraging start has been made, as will be seen by a comparison of the accompanying illustrations.

REMODELING THE PARKS OF LOS ANGELES.
Drive in West Lake Park Lined with Palms.

And as a furtherance of this idea, the aim is to connect the parks by avenues and boulevards in which the informal and the architectural parkings will be blended gradually and almost insensibly one into the other by these threads of communication.

Where streets are not paved it will be possible to extend the curbs and by the saving from the cost in paving defray the cost to replace the curbs and put in the parking.

East Lake and West Lake Parks, Elysian, Hollenbeck and South as well as a number of smaller parks where much has been accomplished by previous administrations must be metamorphosed gradually into the general scheme of things, but in Exhibition and Griffith Parks and in the Arroyo Seco, the present forces have fullest play for their ability.

Griffith Park, with an area of 3,015 acres, the second largest municipal park in the United States, is still in its wild state. It has the latent possibilities of being converted into the finest park in America. One of the necessities for the development of the park, which until now has been largely lacking, is a water supply. This is soon to be made available from the Los Angeles aqueduct. The great acreage includes a small domain of mountain, hills and dale, valley, undulating field and river bottom. The mountain sides are clad with copse and California live oak, while along the river bed there is to be found a dense growth of alder and willow, from whose branches hang tropical mosses in graceful festoons. Here, within ten miles of the heart of Los Angeles, are still to be found deer, quail, rabbits, wild cats and other native game living in their natural state.

So far the development of this park has

consisted largely in the making of picnic grounds, and roads and trails in which nature in some of her happiest moods has been little or not at all disturbed.

A zoo also has been started. Here, with the balminess of the climate that is always manifest, opportunities are offered for permitting the animals to be confined under their natural conditions, and to this end the moat system, conforming with the German idea, will be adopted. A separate organization of public men whose interest has been aroused in this phase of the park board's work has been formed to assist the commissioners in the enterprise. Ultimately the zoo at East Lake Park will be moved to the new quarters, and the city is now seeking a competent director who can not only create and develop plans, but present them to the public in a way to gain its active co-operation.

Next in importance to the improvement of Griffith Park is the proposed parking of the Arroyo Seco (Spanish for "dry river"). This old water way begins in the mountains of the Sierra National Forest Reserve, six miles north of the city of Pasadena, and runs for a distance of firteen miles thru Los Angeles county, the cities of Pasadena and South Pasadena to a junction with the Los Angeles river opposite Elysian Park, which is a five-minute ride from the City Hall. Much of it is heavily wooded and of great scenic beauty, Sycamore Park being already included within its limits. This project, as will be seen, is one in which the interested cities as well as Los Angeles county must and will co-operate.

Exposition Park will be entirely formal. The three great buildings of the Byzantine style of architecture that the State of California is erecting, are to be set in a court of thirty acres and will be tied together by a sunken garden of which the balustrade and the wall will be of red brick, architecturally in keeping with the three edifices. In the center of the court a fountain commemorative of the construction of the Los Angeles aqueduct is to be erected by popular subscription. As a unique and distinctive feature, the entire park is to be surrounded by a conuous hedge of roses. The city in its agreement with the State has provided for the expenditure og $100,000 in ten annual installments for the improvement of this area.

The foregoing gives in large detail the improvements that have been accomplished or are under way in the Los Angeles park system. Los Angeles has been awakened and is cognizant of its laxity hitherto.

One thing has been impressed upon the Park Commission. That body at the present time finds that it acts purely in an advisory capacity to the City Council and both its plans and finances are limited by the graciousness or ungraciousness of that body. The Commission believes that the best interests of the city demand that the Park Board shall have control and supervision over the park area and make rules and regulations for the territory under its jurisdiction. It seeks the power to create and maintain boulevards with the establishment of a sub-department of forestry, which would determine and enforce the planting of trees best suited to the styles of architecture in the different districts. For maintenance it would have a separate tax levy, the same as those now provided for a public library and schools.

These broad changes can only be made by revision of the city charter, a thing which is now being developed on a scientific basis. With the assistance of the city clubs with their several thousand militant citizens, it is hoped to secure these broader powers for the Board as above mentioned in order that the great plans may be accelerated rather than hampered.

ROAD STUDY IN ENGLAND.

By an English Correspondent.

IN the gritting of street surfaces the English Roads Improvement Association discovered that where material was used in the wooden pavements exceeding a quarter of an inch gage, practically no foothold was afforded until the material had been crushed by the traffic. The flint pebbles were either picked up by the rubber tires or kicked to the gutter by the horses' feet. So the metropolitan borough authorities were duly circularized on this point, as gritting with small material gave horses a good foothold greatly reducing the damage to rubber tires, and it was found that there was sufficient elasticity in a rubber tire to enable it to pass over a small piece of grit without the skin of the cover being lacerated. After conducting a large number of experiments in regard to the complaints in connection with tarred roads, it was found that the cheaper and commoner forms of tar, badly or carelessly applied to the road surfaces, were the cause, and that, with the use of a higher-grade binding material, such as bitumen and asphalt, a much more efficient road-surface was formed.

With regard to complaints that a tarred road-surface is unduly slippery for horse traffic, the Roads Improvement Association on investigation found that the

causes were either one or another of the following, all capable of remedy: (1) The application of tar, or similar material, to the road in wet weather, or under conditions when the road metal is not in a fit state to receive it, as a consequence of which the tar never becomes properly incorporated with the road material, and the surface is never satisfactory. (2) The application of tar to a road where, owing to trees, walks, etc., the passage of air and sunlight is limited. (3) An excessive amount of tar being applied when completing the work; this gives an unduly smooth surface, which becomes slippery in certain weathers and specially applies to certain types of tar macadam work. (4) The injudicious use of calks upon horses' hoofs, as these chisel-like devices have the effect of piercing the waterproof coating of tarred surfaces and allow the water to get underneath the tar, which is then lifted and forms a greasy substance. (5) Various local circumstances, such as unsatisfactory road foundations, which cause the surface to become broken up by the traffic, excessive camber, etc.

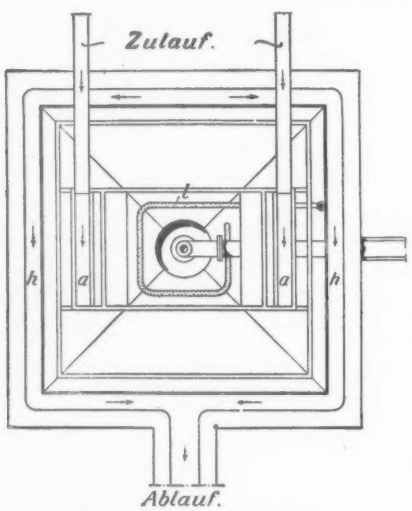
A SEWAGE SEPARATOR.

By Dr. Robert Grimshaw, Dresden, Germany.

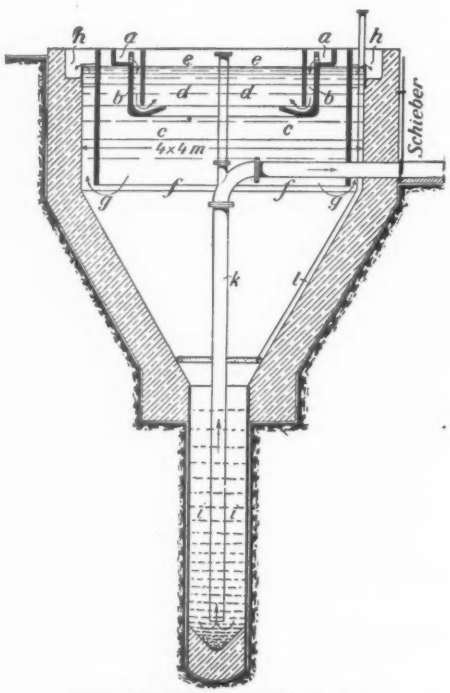
THE illustration shows in plan and vertical section a new mechanically acting sewage separator intended to replace the usual settling tanks, and which has been introduced into several German cities.

With reference to the illustration: *a* are the inlets; *b*, side inlets; *c*, turned-up portions to direct the water upwards; *d*, grease traps; *e*, the upper layer of greasy water; *f*, the clearing chamber; *g*, the edges of the surrounding inner seal wall; *h*, exterior passage for clear sewage; *i*, the mud cylinder; *k*, the mud pipes, from which only thick mud flows, and *l*, the pipe for supplying flushing water.

The principal object is to drive out the mud deposit automatically by water pressure without stopping the general working of the device. The mud deposit being almost free from fat is very suitable for fertilizing purposes. Before being dried, it can be allowed to ferment, which gives it an earthy consistency and deprives it of its disagreeable odor. This fermenting can take place in special reservoirs, either separate or built onto this device.



SEWAGE SEPARATOR. Plan.



SEWAGE SEPARATOR. Section.

The advantages claimed for the arrangement are: That the mechanical separation is effected by clear water instead of by sewage; that the grease is separated from the mud; that the device serves as a preliminary apparatus for plants where the sewage is used for irrigation. It was shown in the Dresden Hygiene Exposition by the Gesellschaft fur Abwasserklarung, Berlin-Schoneberg.

(Zulauf in the plan means inlet, and Ablauf means outlet.)

EDITORIAL COMMENT

STATE CONTROL OF SEWAGE PURIFICATION.

The question of the extent to which the State can carry its control of sewage pollution of streams and of municipalities in requiring them to purify their sewage and levy taxes upon themselves to pay the construction, maintenance and operation expenses, has been an open question until this time, with the presumption in favor of the independence of the city in this regard.

The State of Ohio, in advance of other States, passed an act in 1908 which placed these matters within the control of the State Board of Health, which could require the purification of sewage deemed necessary by it, and the municipality affected was required to levy the necessary taxes to pay the expense necessary to carry out the board's orders. Indiana passed a similar law in 1909.

But little has been done in Ohio and nothing in Indiana toward enforcing the laws, the city of Greenville, O., having attacked the constitutionality of the law. This has now been affirmed by the Supreme Court on appeal from two lower courts. The most difficult question raised was that concerning the discrimination in the law in favor of cities discharging their sewage into the Ohio river, the application of the law in their case being suspended so long as cities in other States bordering on the river discharge their unpurified sewage into the river. The boundary of the State of Ohio is not the center of the Ohio river, but the northerly bank, so that cities discharging sewage into the river are really discharging it into the State of West Virginia or Kentucky. The exception in the law therefore only gives statement of the exception in fact, and is therefore not a discrimination, but merely a recognition of the fact. The States of West Virginia and Kentucky would seem to have some rights in the case which they should be able to enforce.

However, the court took cognizance of the claim made by some that the boundary of the State is the middle of the river, and discussed the case under this supposition, coming to the conclusion that "to compel those persons, corporations, villages and cities bordering upon the Ohio river to refrain from discharging sewage into the Ohio river while the cities on the opposite bank are so doing would serve no purpose and accomplish no good results. * * * The fact that it would be productive of no good results is sufficient reason for the classification and for exempting them from the provisions of this law."

The other points made are that the law provides for compulsory arbitration, places the control of the discretion of city officials in the State Board of Health and delegates the taxing power of the city to the same board.

These are disposed of on the grounds that the powers of a municipality are delegated powers, and the legislature can limit them at its reasonable discretion; that the city has no right to place the burden of pollution upon persons and property below, and that so long as the whole city pays the expense in proportion to its benefit, there is no inequality of taxation such as is contemplated in the provisions of the Constitution of the United States; and that the action of the State Board of Health is to compel the purification of the sewage, the levying of the tax being a ministerial action of

the municipality necessary to carry out its orders, so that the State Board has no direct control over the taxing power of the city or the manner of exercising the same by the city officials.

A general allegation was also made that the order of the State Board of Health was not justified by the facts, but no proofs were presented and there was no discussion of this question in the briefs. The remedy for this would not be in a suit for injunction, and therefore no action was taken by the court on this point.

The Ohio State Board of Health can now proceed with much work which has been delayed, waiting for this decision. The authorities in Indiana will also be relieved regarding the status of their statute, but the delay in action in that State has been not on account of the uncertainty regarding the validity of the law, but on account of the lack of appropriations to pay the expenses of investigations, orders, suits and other proceedings.

These laws place the control of stream pollution in the hands of experts, who can make the application of the sanitary principles uniform and without discrimination, producing the best results with a minimum of expense, friction and injustice. Their adoption by other States will doubtless follow as their advantages are demonstrated.

It is necessary for efficiency, however, that the State Board of Health and its activities be kept out of politics. The recent changes in the personnel of the executive and administrative officers and employes of the Ohio board have not yet been explained satisfactorily, and the charge of political manipulation which has been made is therefore not yet refuted. It is to be hoped that, whatever the reason for the changes, they will not cause a lowering of the high standard set by Dr. C. O. Probst, the former efficient secretary of the board. The advanced position of Ohio in legislation on sanitary matters is the result of his constant, thorough work in agitation, education and direction of the progressive forces of the State.

It is also to be hoped that the next legislature of the State of Indiana will see fit to give to its efficient State Board of Health the money needed to make its advanced legislation effective.

OBSOLESCENCE AND DECREPITUDE AS FACTORS IN DEPRECIATION.

In continuation of the discussion of depreciation in public service plants, begun in the editorial on "Theories of the Valuation of Public Service Industries," on page 34 of the July number, some attention may be paid to particular differences in application of the principles there stated under the conditions which arise. Some of these are considered in a paper by William B. Jackson on depreciation and reserve funds, before the Western Society of Engineers, and again the proper understanding of principles and methods of applying them is promoted by his accuracy in determining the differences between the terms used.

Mr. Jackson follows the general custom in including in the term depreciation two elements, decrepitude and obsolescence. Strictly speaking, depreciation should be applied to decrepitude only, and the line of reasoning followed in the preceding editorial is strictly applicable only to the provision for replacing the value of the plant lost through its progressive decrepitude or providing a sinking fund to pay the bonds when this progress in decrepitude extinguishes the plant.

Obsolescence is not decrepitude physically, tho it may be so considered theoretically, and it has been included in depreciation mainly because the physical difference between decrepitude and obsolescence has not been recognized. It really requires different treatment, and most of the difficulties in the practical handling of depreciation charges arise from the attempt to include the two elements in the same charge.

Were there no advancement in invention there would be no new and better methods of performing the service required of the plant. The practical reasons for substituting new machinery for old are either reduction in cost of maintenance or operation, or both, enough to warrant the change, or improvement of the service, or a combination of the two.

If the only result is an improvement of the service, it is evident that the price for the service should be increased enough to pay the cost of the new machinery during the period of its life, in addition to the cost of the old machinery which was discarded. As in one of the cases which Professor Jackson mentions, the depreciation on both old and new machinery should properly be charged off each year, notwithstanding the fact that the value of the plant is actually diminished, at the time the old machinery is abandoned, by its value on the books at that time, less the salvage obtained by its sale.

If the only result is to reduce the cost of operation, the question which arises is one of equation of cost of operation with the old plant and cost of operation plus the new capital charges with the new plant. If the former is the greater, the change will be made. And, if the value of the plant is left as it was before the change was made, there will be a profit to the operators, without taking into account the increase in actual investment in the plant.

Ordinarily both improvement in service and decrease in cost of operation are involved, so that there can be no fixed rule for computing the effect of obsolescence. Each change of this nature must be considered by itself if an exact result is to be obtained. Any rule can be based only on more or less accurate averages of what has happened in the past, and can therefore not be blindly applied to the future, undoubtedly different, conditions, and will never fit exactly the conditions at any one plant.

In valuations of plants for the purpose of fixing rates, if there is a full history of the plant, it should not be exceedingly difficult to make the necessary computations and to make the proper allowances for the replaced machinery and that replacing it.

It is evident that a comparatively stable charge, such as decrepitude, especially when we have the elaborate modern tables of depreciation per annum for so many of the minute details of a plant, should not be combined with one which is so obviously irreducible to rule or formula as obsolescence, and the sooner our valuation experts make the separation the sooner their conclusions will begin to travel toward accuracy and exact equity.

Professor Jackson makes a separate fund of required reconstruction and special insurance, which he calls a reserve fund. But these are largely matters of contract, and while they may be fairly regular for a single plant, will vary greatly for plants in general. The obsolescence charge may be combined with the reserve fund for the purposes of the treasurer, but it should be computed separately and kept separately on the books of the company.

Inadequacy is another factor which Professor Jackson discusses to some extent. He likens it to obsolescence, but shows that it is much more subject to engineering judgment than is obsolescence, and in well-designed plants is therefore fairly negligible. In plants begun small and suddenly outgrown, on account of unexpected increase in population of the city, it is scarcely different from obsolescence. It is likewise a charge which varies in various localities and with little or no relation to any local conditions except the two mentioned, and should therefore receive the same special and individual attention which obsolescence does. Inadequacy is therefore simply a section or variety of obsolescence and may be included in the same fund.

THE QUESTION DEPARTMENT

Patents on Road Construction and on Metal Culverts.

The writer has noticed that you gave a list of patents on road and paving construction and repair in your November, 1911, number. Do you have this list of patents in book form? Also advise us whether you have ever published a list of patents on metal culverts.

G., ———, Ind.

The list of patents on road construction and repair in vol. xli, p. 410, was continued in vol. xlii, p. 68 (Jan., 1912), and is further continued in this number. It will be brought down to date as rapidly as the space available will permit. A short list of patents on culverts and bridges was printed in vol. xxxvii, p. 418. It also will be brought down to date shortly. These lists are compiled from the weekly numbers of the U. S. Patent Office *Gazette* and have appeared nowhere except in MUNCIPAL ENGINEERING.

Resolution for Improvement of Village Street by County Authorities.

Please send a copy of a resolution by board of trustees of a town giving their consent to the improvement of a street as provided in the Acts of 1909, Section 2 of an act concerning highways (page 355).

M., Town Attorney, ———, Ind.

If the board of trustees of the town desires the street included in the line of highway to be improved by the township to have the same character of improvement as the road outside the town limits, it would seem to be sufficient for the resolution to provide "that the Board of Trustees of the Town of ——— concur in the improvement of the road (describing the line) and in the improvement of that portion thereof within the limits of the Town of ——— (describing this section) according to the officially adopted plans and specifications therefor, and consent thereto under the provisions of Sec. 2, of Chapter 148 of the Laws of 1909."

If, however, the town desires the portion within its limits to be improved in some other manner, then the resolution should set forth and, under the provisions of the law may set forth, a full description, including plans and specifications for the kind of improvement desired. The provision that street paving materials shall not be used except upon streets within the corporate limits of cities and towns is evidently intended to give the city or town the right to require such pavement to be laid if it so desires. If the town so prescribes a paving material or a method of laying the material used, or a plan for curbs, gutters or other variations from the road construction adopted for the road outside the town limits, it would be well to include in the resolution a statement that the town assumes the excess in cost of this section over that of the parts of the road outside of city or town limits.

Septic Tank Specialists.

I have a subdivision of some 500 lots I wish to sewer. I will have to use a septic tank system. Can you put me in communication with some company whose specialty is septic tanks?

A., ———, Tenn.

The Cameron Septic Tank Co., 352 Monadnock Bldg., Chicago, Ill.; Russell Sewage Disposal Co., 607 Marquette Bldg., Chicago, Ill.; Merritt & Co., 117 N. Front street, Camden, N. J., make a specialty of septic tank and similar methods of sewage disposal.

Reference may be made to the "Business Directory" published in each number of MUNICIPAL ENGINEERING for names of specialists in sewage disposal, both manufacturers and engineers, and of apparatus and materials, under the headings, "Air Compressors," "Air Pumps," "Bleaching Powder," "Chemists—Consulting," "Civil Engineers," "Consulting Engineers," "Contractors," "Ejectors," "Flush Tanks," "Powder, Bleaching," "Sanitary Carts," "Septic Tanks," "Sewage Disposal," "Sewage Ejectors," "Sewage Pumps, "Valves, Air."

How to Find a Lost Sewer.

I would like to know if any of the readers of MUNICIPAL ENGINEERING have had any experience in locating a lost sewer. We have about three-fourths mile of out-fall sewer with two manholes and the outlet located. We know it does not run on a straight line between the known points, and we have tried and found that it does not run where the field notes say it should. That part of the city in which the sewer is located has been built up considerably since the construction of the sewer, and most of the ground has

been filled from one to three feet, so that all trace of the ditch is lost. I would like to receive suggestions in regard to manner of locating intermediate manholes without going to an excessive expense of digging long trenches either along or across the supposed line of the sewer.

E. W. R., ———, Mo.

Will our readers report their experience in like cases?

No indication is given as to the possible depth of the sewer. If not too deep, a pointed rod can be driven down until it strikes the sewer or has certainly passed it. There must be some idea of the location of the line, and the rod or rods can be driven down in holes close enough together to insure striking the sewer somewhere. If the sewer is small this would necessitate holes close together; for example, if it is 12 inches in diameter, the holes should be not more than 9 nches apart. The line of holes would run across the line of the sewer. If the flow of the sewer is rapid enough or obstructed enough to make a noise, an audiphone held on the rod after it is driven down may detect the proximity of the sewer. If there is rock or hard pan under the surface and above the level of the sewer, the search will be easier, because the sewer will be in the disturbed and softer trench, and the sound of the flowing water may be more easily transmitted.

One engineer reports that he has used a blunt rod which was worked up and down in a hole kept wet with water, and that such a rod can be forced down thru the soil for six feet or so in about ten minutes. Driving the rod would require something to lift the operator up high enough to strike the top of the rod and would require a stiffer rod.

Cost of Electricity for Pumping.

We want to secure some information in regard to what various cities and towns are paying central stations for electricity used as power in their pumping plants.

C. D. P., Boston, Mass.

Can our readers give any information directly to the point?

A few cities buy current for electric street lighting by measurement, the popular price being 10 cents per k. w. Some cities pay as little as 5 cents, and one or two as much as 20 cents. Several cities in California buy current from power companies, mainly for lighting, but Gridley and Lodi seem to pump water by electricity also.

If the pumping can be done in the daytime or at such other times as the demand on the electric plant for other purposes is well below the maximum, undoubtedly better rates can be secured, possibly as low as 2 or 3 cents under favorable circumstances.

There are but few electric pumping plants and they are small or are run under special conditions. Small towns can pump their water supplies by electricity in combined electric light and water plants if there is business enough to keep the plant running all the time, at night making light and in the day pumping water. In such towns there is little or no demand for day current from an electric light plant, but there are doubtless some electric light plants that would be glad to sell current for pumping in the day time at low prices because such use would be practically clear profit.

Terms of Water Works Franchise.

Our small city is considering a new franchise for its water company, and we would like to have some information about what others are doing in this line.

City Attorney, ———, Ind.

Conditions and opinions have changed materially since the expiring franchise was granted, even if its term was limited to the twenty-five years now possible under the Indiana law. The newer franchises recognize these changes. Unfortunately, but few franchises have been changed in the smaller cities and but few of them have embodied the later ideas, because they have not had the necessary expert assistance, and because the city councils could not quite bring themselves to make the material changes necessary. In some cases this reluctance may be due to the fear that an equitable ordinance might raise the rates, in other cases it may be based on influence not definitely located.

Several of the proposed franchises for various public service industries which embody the modern principles have been discussed in MUNICIPAL ENGINEERING. One which applies most directly to this case will be found in "An Outline of a Contract Between a City and a Water Works Company," vol. xxxv, p. 247. Some of the essential points in a franchise for a water company are noted in "Terms of Water Works Franchise," vol. xxxvi, p. 177.

Wilcox's book on "Municipal Franchises" (Vol. I, $5), discusses existing franchises. It gives the terms of what is called a model water franchise, outlined in 1892, which is excellent in its provisions of physical qualifications, but contains no hint of the modern provisions set forth in the first article referred to above. The book gives a general idea of the terms of a water franchise for Ann Arbor, Mich., which is also excellent so far as physical provisions are concerned, and provisions for a board of complaint and for annual reports of receipts and expenditures of the company are also of value. The New Haven franchise is discussed largely as one which contains unsatisfactory provisions. The Indiana law governing the issue of franchises since 1905 is quoted with approval, but the Indianapols water franchise, which is also quoted in part, has not yet been considered as amenable to the regulations of the present law, because of a provision which continues the old contract after its expiration until a new contract, satisfactory to both parties, is made. San Francisco, Los Angeles, New Orleans, Denver, Butte, Birmingham, are quoted mainly to show objectionable features, and Knoxville to show the

court decision confirming the city's right to regulate rates.

The report of the National Civic Federation on "Municipal and Private Operation of Public Utilities," three volumes, discusses franchises and conditions of water supplies in Cleveland, Chicago, Syracuse, New Haven, Utica and Indianapolis, which are all materially larger than the city under consideration.

Adrian, Mich., with 11,000 population, has an old contract which expires in 1913. As regards fire protection the present contract as modified from the first one granted provides that the system shall at all times be capable of throwing eight fire streams, each thru 50 feet of hose and 1-inch nozzle, 100 feet in height; that the city rent at least 150 hydrants and one additional for every 600 feet of pipe extension; that hydrants be double nozzle with frost jackets; that the city use hydrants for sewer flushing only at certain hours; that the company test all hydrants twice a month and those in the paved district daily when the temperature is below zero; and that the water company forfeit six months' hydrant rental for failure to furnish water at the required pressure at any fire. This contract is considered inadequate for protection, and it is recommended that the new contract require additional 4,000,000 gallon pump and 150-h.p. boiler, fireproofing of pumping station or its equivalent; metering of all services; strengthening mains so that a flow of 1,500 to 2,000 gallons per minute under fire pressure can be obtained in residence district, 2,500 gallons in manufacturing districts and 3,500 gallons in the principal mercantile district. The improvements in mains recommended to produce this result are stated and in general minimum sizes of mains are recommended; namely, 6 and 8-inch in residence districts, the latter in blocks 600 feet or more in length and on all dead ends; 8 and 12-inch in mercantile and manufacturing districts, the latter for long lines not cross-connected; and that all 4-inch mains be replaced within five years. It is also recommended that gate valves be so placed as to reduce to 800 feet the length of pipe necessary to shut off to repair a break; that there be two hydrants at each street intersection and intermediate hydrants not more than 250 feet apart in principal mercantile districts, one hydrant at street intersection and one intermediate on blocks more than 400 feet long in minor mercantile and closely built residential districts; that hydrants have two hose outlets, 6-inch barrel and 6-inch gated connection to main.

The requirement of capacity in gallons per minute rather than a certain number of fire streams to a certain height is excellent, as it makes the requirement more definite and so more easily tested.

Raleigh, N. C., with a population of 20,000, has the following franchise provisions regarding fire protection:

The company shall maintain a pumping capacity and a supply of water adequate to the needs and demands of the city, with power sufficient to discharge six 1-inch nozzle streams, using 50 feet of 2½-inch rubber hose taken from six separate hydrants located in the business part of the city, to a height of 100 feet, or its equivalent in pressure, say, 60 pounds, from the mouth of said hydrants, and at another time to throw from separate hydrants in other portions of the city four such simultaneous fire streams.

The company shall at all times be prepared to furnish effective hydrant streams without the aid of portable engines, from hydrants having a pressure from water tower of not less than 40 pounds, and from direct pressure not less than 60 pounds per square inch. Such pressure maintained at the hydrants to be the measure of liability of said water company, which shall not be responsible for the proper application of the water.

A water tower of at least 100,000 gallons capacity shall be maintained at an elevation of 110 feet above the street level at Capitol square, which tower shall be connected to the street mains by a pipe of diameter not less than 12 inches, in which pipe there shall be a valve which can be closed and thereby allow an increased pressure to be carried on the street mains.

The city shall rent at least 137 hydrants at the rate of $32.50 per year, may order extensions to street mains not to exceed two miles in length during any one year, provided ten hydrants be set per mile of extension and paid for at the above mentioned rate, and may cause additional hydrants to be set on existing mains by paying for each hydrant an annual rent of $25. The chief of the fire department to have charge and control of hydrants, to cause inspections to be made, and the water company to maintain same in good operative condition. The use of hydrants to be confined to the extinguishment of fires, flushing of gutters and sewers, and sprinkling of streets. The company reserves the right to install meters on all services.

The above contract is considered deficient from the standpoint of fire protection, the size and number of fire streams guaranteed being entirely inadequate for the control of serious fires. It is recommended that the number of hydrants be increased to two at each street intersection and one midway of all blocks of 400 feet or more in mercantile district, hydrants not more than 300 feet apart in manufacturing districts, and not over 350 feet apart in well-built-up residential districts, with mains of size to serve them; hydrants in mercantile and manufacturing districts to have three or four hose outlets, not less than 8-inch barrel and 8-inch gated connection to main and other hydrants two or more hose outlets 6-inch barrel and 6-inch gated connection with mains.

A number of cities somewhat larger than the one under consideration have made new

contracts whereby certain portions of the old systems shall be replaced or reinforced each year until the requirements conform to the necessities of the present and the probable necessities of the future, which provisions can be quoted if desired.

The exact wording of these requirements and the method of providing for their modification as conditions change require the assistance of engineers expert in such matters to give the city the service which its conditions require and at the same time give the company the compensation to which it is justly entitled for supplying this service. To render the most efficient service, the engineer must be given an opportunity to study the problem on the ground and to form a reliable opinion of the probable demands of the future.

Best Form for City Charter.

I would like to have your idea as to where I can get the best models for a municipal charter for a city of a hundred and fifty thousand population. In Alabama we have a general municipal charter which supersedes all the former special charters. I would, however, like to have a suggestion as to the names of the two or three states having the best model general municipal codes as well as the two or three cities having the best special charters. I have the Ohio work of Ellis' "Municipal Code" and also the Indiana work of Thornton's "Laws of Cities and Towns." I am inclined to think some good models might be gotten from Minnesota, but this is merely a surmise.

B., City Attorney,
———, Ala.

The charter of the city of Boston seems to the writer to contain the most satisfactory working out of the business principles which should be applied in a city government, and in general to have the best methods as yet developed for reducing to a minimum the influence of politics in the details of the administration of the system. A careful study seems to have been made of all the forms of city government which have been in use. The principles of municipal government which have been most successful have been chosen and the details of the application of these principles have been improved wherever they have been found unsatisfactory.

In many of the attempts which have been made to improve municipal government, defects in details and in applications of principles have been confused with defects in the principles themselves and really good systems with poor working out of details have been discarded for poor systems which work well at the beginning because of the great improvement in some of the more important details of administration. The Boston result bids fair to be the most permanently successful because it has the most efficient combination yet made of correct principles and good detail in their application.

The analogy of a municipal corporation to a business corporation has often been shown in MUNICIPAL ENGINEERING. The principal difference is in the fact that the municipal corporation is essentially a money-spending and not a money-making organization. The methods of measuring the efficiency of its officers must, therefore, be somewhat different. One of the principal difficulties in municipal government is that of securing the best men for administrators of the policies determined upon by the people, which is tied up in very many cases with the difficulty in registering by an independent vote the true desires of the people as to the policy to be adopted. When cities apply the same business principles to the selection and retention of competent elective officials and appointive employes which have been applied in such cases as the Boston charter and the general charter for Indiana cities in providing a business-like plan for the general administration, the results of municipal government will be more satisfactory.

The safeguards which have been thrown about the commission form of government to make its success reasonably certain could be applied to the business form adopted by Indiana more than twenty years ago and would give more satisfactory results than are now obtainable by the commission form. Boston has applied some of these safeguards and is apparently securing the desired results with considerable success. No doubt additional efficiency can be developed after a few years of experience.

The books mentioned in the question give the laws governing municipal corporations in Indiana and Ohio and some of the results of their practical application. Bradford's "Commission Government in American Cities" gives the student's point of view. It needs information from the practical administrator of a city and from one familiar with methods of political manipulation to make it complete.

Some recent articles in MUNICIPAL ENGINEERING give information concerning various forms of charters and sources of information.

In vol. xlii will be found the following: "Municipal Economy and Efficiency," p. 462, outlining the success of methods in use in Boston and elsewhere for checking up and overseeing municipal officials by official and unofficial organizations independent of the municipal administration; "The Election of Administrative Officers of Municipalities," p. 111.

In vol. xli: "Municipal Efficiency Bureaus," p. 309; "Forms of Municipal Government in Europe," p. 256; "Commission Government in Trenton, N. J.," p. 313.

In vol. xl: "Best Form of Municipal Charter," p. 127, giving suggestions as to methods of attacking the problem; "Comparison of Des Moines and Indianapolis Forms of Municipal Government," p. 8, one having the commission form and the other a business form; "Information About the Commission Form of Government," p. 126, giving references to

earlier articles on the subject; "Commission and Other Forms of City Government," p. 45, which also has references to earlier articles; "Small Cities with Commission Form of Government," p. 124; "Cities Having Commission Government," p. 431.

The general conclusion of students of municipal government is that almost any form of administration will be successful if the city officials are competent, honest and interested in their work, but that no system is capable of making men honest or competent. The provisions of first importance are those which make it possible for the citizens to overthrow a corrupt administration when they so desire, and which provide for independent watch over the acts of officials so that they must always be ready for investigation. There may be many excellent methods provided for taking care of the details of administration which make the work easy and simple, but they are of little value unless the citizens take enough interest in their government to select the proper men to carry out their wishes. Another very desirable feature of a city charter is one which keeps in employment subordinates who have proved themselves honest and efficient, and removes them from the influence of the politician who wishes to reward his friends by appointing them to office, whether fitted for it or not.

Information About Central Station Heating Plants.

I am advised that you have special information department from which we would like information relative to the subject of municipal central heating plants, as to the desirability of such a plant, also as to which is the most desirable, steam or hot water for a plant of that kind.

C. L. W.,
Chairman Ways and Means Com.,
Commercial Club, ———, Minn.

There has been no book on "Central Station Heating" until very recently. Byron T. Gifford has recently published one on this subject which is now on sale at $4. It sets forth the advantages of central station heating, the sources and amounts of loss in pipe lines, the principles of pipe line design, method of making rates, descriptions of steam and hot water heating stations, methods of operating and maintaining plants, especially hot water plants, and has brief discussions of management and of franchise with outlines of hot water, steam and combined heating franchises. Building equipment is also considered in some detail from radiation to weather records.

Articles in MUNICIPAL ENGINEERING give much of value in this field, some of the more recent being the following:

In vol. xxxix: a review of Baldwin's book on "Heating" ($2.50) on p. 145, which book gives instruction on details of house installation.

In vol. xxxvi: "Central Station Steam Heating," p. 93, a description of the plant at Johnstown, Pa.

In vol. xxxi: "Rates for Heating Service," p. 445, comparing methods of charging for central station heating service; "Central Station Heating Plants, p. 455, giving a full list of cities having such plants, both steam and hot water.

In vol. xxviii: "Central Station Heating Plants," p. 26, giving full statistics and tabular description of many plants. Statistics are also given in vol. xix, p. 412, and vol. xx, pp. 20, 152.

Three articles by Alton D. Adams on "Heating from Central Stations" in vol. xx, pp. 65 and 136, and vol. xviii, p. 351.

A paper on "Central Station Heating" in vol. xxvii, p. 450.

There are several others upon the subject of less importance or of special application.

Books on Plumbing.

We wish to get a bibliography of books on the subject of plumbing for the use of water works engineers. Do you publish such lists or can you tell us where they may be obtained?

MRS. F. E. BRYANT,
Librarian School of Engineering,
Lawrence, Kan.

Following are books on plumbing and pipe fitting, most of which will be of interest to water works men as well as plumbers and pipe fitters:

"American Plumbing Practice" ($2.50).
"American Steam and Hot Water Heating Practice" ($3).
"Plumbing and House Drainage Problems" ($2).
"Practical Gas Fitting" ($1).
"Practical Hints on Joint Wiping" (25 cents).
"Steam Heating Problems" ($3).
Ainge's "Sanitary Sewerage of Buildings."
Allen's "Roughing in House Drains," "Swimming Pools," and "Sanitation in the Modern Home."
Baldwin's "Hot-Water Heating and Fitting" ($4).
Ball's "Plumbing Catechism," Billings's "Details of Water Works Construction" ($2).
Birkmire's "Planning and Construction of High Office Buildings" ($3.50).
Brown's "Water Closets" ($1).
Clow's "Practical Up-to-Date Plumbing" ($1.50).
Cosgrove's "Principles and Practice of Plumbing," "Sewage Purification and Disposal," "Plumbing Plans and Specifications" and "Wrought Pipe Drainage Systems" ($2).
Donaldson's "Hot Water Heating, Steam and Gas Fitting" ($1.50).
Gerhard's "Sanitary Engineering of Buildings" ($5).
Gerhard's "Sanitary Drainage of Buildings" (50 cents).
Gerhard's "American Practice of Gas Piping and Gas Lighting" ($3).
Gerhard's "Guide to Sanitary Inspections" ($1.50).
Gerhard's "Modern Baths and Bath Houses" ($3).
Gerhard's "Sanitation of Public Buildings" ($1.50).
Gerhard's "Water Supply, Sewerage and Plumbing of Modern City Buildings" ($4).
Gray and Ball's "Plumbing" ($1.50).

Jessup's "Contract and Estimate Record Book for Plumbers" ($1.50 and $2.50) and for "Steam and Hot Water Heating" ($1.50).
Kaiser's "Repair Kinks for Plumbers" (50 cents).
Kidder's "Architects' and Builders' Pocket Book" ($5).
Lawler's "American Sanitary Plumbing" ($2).
Lawler's "Modern Plumbing, Steam and Hot Water Heating" ($5.50).
Lawler's "Practical Hot Water Heating, Steam and Gas Fitting" ($2).
Lincoln's "Practical Steam and Hot Water Fitting" ($1).
Maguire's "Domestic Sanitary Drainage and Plumbing Lectures on Practical Sanitation" ($4).
McNeil's "Steam and Hot Water Fitters' Text Book" ($1).
Morris's "Steam Power Plant Piping Systems" ($5).
Richey's Building Mechanics' Ready Reference Series, "Plumbers', Steam Fitters' and Tinners' Edition" ($1.50).
Richey's "Hand Book for Superintendents of Construction," etc. ($4).
Richey's "Building Foreman's Pocketbook" ($5).
Starbuck's "Standard Practical Plumbing" ($3).
Starbuck's "Modern Plumbing Illustrated" ($4).
Starbucks' "Practical Wrinkles for the Plumber" ($1).
Starbuck's "Questions and Answers on the Theory and Practice of Steam and Hot Water Heating" ($1).
Starbuck's "Questions and Answers on the Practice and Theory of Sanitary Plumbing," 2 vols. ($1 each).
Starbuck's "Hot Water Circulation" ($3).
Waring's "How to Drain a House" ($1.25).

Some English books are the following:

"Architectural Hygiene" (5 shillings).
Allsop's "Public Baths and Wash Houses" (6 shillings).
Bjoerling's "Pipes and Tubes: Their Construction and Jointing" (3 shillings 6 pence).
Buchan's "Plumbing" ($1.40).
Coleman's "Sanitary House Drainage" ($2).
Colyer's "Water Supply, Drainage and Sanitary Appliances of Residences" ($1.50).
Cross's "Public Baths and Wash Houses" (21 shillings).
Davies's "Standard Practical Plumbing," Vol. I ($3), Vol. II ($4.50).
Davis's "Plumbing and Sanitation" (30 shillings).
Denton's "Water Supply and Sewerage of Country Mansions and Estates" ($1.25).
Dye's "Hot Water Supply" ($1).
Dye's "Hot Water and Steam Cooking Apparatus" (60 cents).
Eldridge's "Engineers' Practical Guide for Fixing Hot Water Apparatus and Warming Greenhouses and Buildings" (40 cents).
Hart's "Hints to Plumbers" ($3).
Hart's "Sanitary Plumbing and Drainage" ($3).
Hart's "Principles of Hot Water Supply" ($3).
Hellyer's "The Plumber and Sanitary Houses" (12 shillings 6 pence).
Herring-Shaw's "Domestic Sanitation and Plumbing" ($5), 2 vols.
Ingham's "Household Boiler Explosions" (50 cents).
Jensen's "House Drainage and Sanitary Fitments" (5 shillings).
Jensen's "Modern House Drainage Plans and Diagrams" (2 shillings 6 pence).
Jensen's "Drainage Inspection and Sanitary Surveys" (2 shillings 6 pence).
Jones's "Heating by Hot Water" ($1.50).
Latham's "Sanitation of Domestic Buildings" (2 shillings 6 pence).
Maxwell's "Drainage Work and Sanitary Fittings" (1 shilling).
Maxwell and Brown's "Encyclopedia of Municipal and Sanitary Engineering" ($10).
Middleton's "Drainage of Town and Country Houses" ($3).
Munro's "Kitchen Boiler Explosions" ($1.20).
Putnam's "Plumbing and Household Sanitation" ($3.75).
Putnam's "Improved Plumbing Appliances" ($1).
Raynes's "Domestic Sanitary Engineering and Plumbing" ($3).
Reid's "Practical Sanitation" (6 shillings).
Smeaton's "Plumbing, Drainage, Water Supply and Hot Water Fitting" ($3).
Stanger's "Sanitary Engineering" (40 cents).
Sutcliffe's "Modern Plumber and Sanitary Engineer" (6 shillings).
Sutcliffe's "Modern House Construction" (2 pounds 10 shillings).
Sutcliffe's "Sanitary Fittings and Plumbing" (5 shillings).
Taylor's "Water Pipe Discharge Diagrams" (12 shillings 6 pence).

Such books as Moore and Silcock's "Sanitary Engineering" and Vernon-Harcourt's "Sanitary Engineering," in common with other English books on the subject, contain several chapters on the plumbing of houses for drainage and water supply.

Proper Width of Sidewalks.

We are planning to repave the business section of this city, and the question of the proper proportion of the width of sidewalks and roadway has arisen, and as its proper determination is a matter of serious importance, I am writing to ask if you will kindly advise me what the experience of Indianapolis has proven to be the best proportion for width of sidewalks and roadway?

N., ——, Ala.

The question of width of sidewalks is certainly a very important one upon business streets. The tendency has been to make the sidewalks too narrow and the street pavements too wide in both business and residence streets. The pavement should be narrow on a residence street, for economy, width not being necessary for the traffic, and cost, comfort and beauty being favorably affected by reducing the width of the pavement and throwing the space thus saved into a lawn, preferably between the curb and the paved strip of sidewalk. If a street railway should later occupy the street, or business traffic should crowd it, the curbs can be set back and the street pavement widened at the first necessity of repaving. This has been done in Indianapolis, where the ratio of paved street surface on residence streets without street car tracks is 50 per cent. of the total street width in narrow streets, and even less in streets of over 60 feet between property lines. The purpose in Indianapolis where there are street railway tracks in a street has been on residence streets to reduce the street area to the minimum possible for traffic, and some such streets are 37 feet between curbs, leaving sidewalks each 11.5 feet on a 60-foot street. This is rather

narrow, but 40 feet makes a comfortable width of pavement, and on residence streets a 10-foot sidewalk and lawn is not bad.

On business streets the experience clearly shows that the sidewalks should be as wide as possible, even at the expense of comfort in the street. Many more people are delayed and inconvenienced by narrow sidewalks than by narrow streets if the street traffic is properly regulated and required to keep always to the right side of the street.

Again, there must be a difference between wholesale and retail streets, and there must be regulation of the use of sidewalks as well as of street area.

On a retail business street the first and most important consideration is the foot passenger traffic. Second is the regularly moving traffic, including the momentary stoppage of vehicles to let off passengers, and third is the standing of vehicles along the curb while the occupants are attending to business in shops, stores and offices. This last becomes a very important consideration about tall office buildings, especially if they are occupied by physicians, real estate men and others who use automobiles or other conveyances constantly. A 40-foot pavement is rather narrow for this use in addition to a double-track street railway and free passage for other vehicles between cars and standing automobiles, but it can be used. Any increase up to 50 feet improves the conditions, but even 40 feet provides fairly reasonable accommodation for all three classes of street use. The traffic being required to move always in the same direction, slow-moving traffic will have no delays except those due to street crossings, and more swiftly moving traffic will have but little more delay than should be enforced upon it by the traffic regulations, being able to pass the slower moving vehicles by taking to the street railway tracks in the intervals between street car passages. Fifteen feet is a narrow sidewalk for a busy retail street, and should be the limit if it is in any way possible to take care of the street traffic on the remainder of the street width. It is possible to make a very satisfactory street on 70 feet between property lines, with 40-foot street pavement and 15-foot sidewalks. Indianapolis has many 15 and 20-foot sidewalks on 90-foot streets, that being the usual width of the business streets aside from the central and main street, which is 120 feet wide, with 20-foot sidewalks, and the diagonal avenues, which are 100 feet wide, with 20-foot sidewalks.

On wholesale streets, street pavement width is somewhat more important if wagons must back up to the curb for loading and unloading; and foot traffic is probably much less. But there must be strict regulation of the use of the sidewalks in handling goods, otherwise the passageway for foot passengers will be reduced enough to cause inconvenience and delay. Indianapolis finds 20-foot alleys in the rear of the principal retail stores of great value in handling the delivery wagon business, and would doubtless plan for the same in the rear of its wholesale houses if it had the opportunity.

Cost of Tunnel in Limestone.

We are considering a power proposition on a small river at this place, and a part of the work would consist of cutting off a twelve-mile bend in the stream by driving a twelve-hundred-foot tunnel thru the bluff at neck of bend. Can you give us any idea what this tunnel should cost? It would be driven through stratified limestone that lies nearly flat. The limestone is not the blue flinty kind, but appears to be moderately hard and contains some sand. The tunnel would be about 6 feet by 12 feet by 1,200 feet. The roof, I think, would be self-supporting. All I ask is a rough estimate of what such work should cost, as the feasibility of the proposition depends on the cost of this tunnel.

Perhaps you can refer me to some books on engineering subjects that would give me the desired information.

I attempted to take this matter up with an engineer and pay him for the information, but he would not give me text-book information or say whether the tunnel would cost $10 or $50 per foot until he had made a survey and personally investigated the situation at $25 per day and expenses. I believe he could have told me what such work usually costs, and then I would have known if it was worth while to investigate further.

P., ——, Mo.

The engineer is right about it, and it would not be possible to make any reasonably accurate figure of the cost of the tunnel from the data given. Figures of cost of excavation in tunneling given in Gillette's "Handbook of Cost Data" ($5) vary from less than $1 to more than $7.50 per cubic yard, according to local conditions, including character of rock, so that "usual cost" is a very indefinite term. It is quite possible that the tunnel must be lined, in which case the cost will be materially increased. Examination of the weathered and fresh rock by an expert would be necessary to judgment on this point, and even then the decision may be wrong. Prelini's "Tunneling" ($3) gives some information which will be of value in making up an opinion on the case.

Books on Street and Sewer Inspection.

Kindly inform as to what books you have covering the subjects of street and sewer inspection. I would like to get full up-to-date information and data concerning the same, and as your journal covers this field of engineering, I feel that you are in a position to advise.

A. L. D., San Francisco, Cal.

Byrne's "Inspection of the Materials and Workmanship Employed in Construction" ($3) is probably the book most nearly meeting the demand. Hill's "Concrete Inspection" ($1) is a good book devoted specially to concrete.

FROM WORKERS IN THE FIELD

The Effect of Creosote Oil on Bituminous Fillers for Creosoted Wood Block.

To the Editor of MUNICIPAL ENGINEERING:

Sir—In my article on page 43 of the July number of MUNICIPAL ENGINEERING the headings of the table are misplaced, which makes the article confusing. I am giving you below the table as it should appear.

TABLE SHOWING THE EFFECT OF ADDING CREOSOTED OIL TO BITUMINOUS FILLERS.

Designation.	Penetration at 77-deg. F.	Point. Melting	5 pct. Creosote added.		10 pct. Creosote added.	
			Melting Point.	Penetration at 77-deg. F.	Melting Point.	Penetration at 77-deg. F.
A	25	142	138	....	122	..
B	20	168	149	34	138	53
C	14	152	136	26.5	126	42
D	28	170	168	42	159	54
E	30	292	292	31	266	33
F	35	167	140	57	122	112
G	30	198	187	38	172	52
H	33	169	150	52	136	98
I	28.5	190	188	38	168	52
J	20	211	204	23	188	32
K	30	273	234	33	210	36

A, B and C are tars. D, E, F, G, H, I, J and K are asphaltic materials.

In the table the second and third columns give the melting points and penetration at 77 of the original substances; the fourth and fifth columns give the melting points and penetrations of the substances plus 5 per cent. creosote, and the sixth and seventh columns give the melting points and penetrations of substances plus 10 per cent. creosote.

HENRY M. MILBURN,
Chemist, Testing Laboratory, Engineering Department, Omaha, Neb.

Bituminous Paving Expert Evidence.

To the Editor of MUNICIPAL ENGINEERING:

Sir—It is generally understood in legal proceedings that "expert evidence" is, in reality, no more than a technical argument made on behalf of his employer and client by one somewhat skilled in the art. For this reason we often hear the statement that "expert evidence must be taken cum grano salis." The best the court can do with "expert evidence" is to endeavor to "separate the wheat from the chaff," and, like the arguments and briefs of opposing counsel, endeavor to arrive at a just decision between the exaggerated claims and plausible arguments of the two sides. The best opposing counsel can safely do with the "expert" is to try by cross-examination and rebuttal to disprove his claims in which the attempted evasion of the "expert" in answering troublesome questions has a very important bearing.

So much for the "expert" in connection with legal evidence. But when we come to the "expert" giving instructions to an engineering class, advising municipal corporations, and writing papers for technical associations or publications, we have the right to expect to find him arguing for the best construction rather than for the interests of his clients, in opposition to the interests of their competitors.

In the June, 1912, issue of MUNICIPAL ENGINEERING is a paper, "Use of Bituminous Materials on Highways in 1911," originally read before Section D of the American Association for the Advancement of Science, which, while mentioning no names, is so clearly an attack on Warren Brothers Company and its patents: so clearly of the nature of arguments of the paid advocate, and so free from impartial "expert advice" as to warrant the writer of this communication in making a somewhat categorical reply thru the pages of the periodical which published the paper referred to.

One would suppose that "expert advice" on this subject would be along the line of "how to construct the best pavements," while the real subject of the paper referred

to is an effort to avoid prominent patents which have been favorably adjudicated by the highest courts of the land, almost regardless of how much such avoidance may be derogatory to the success of construction.

Incidentally the paper referred to, which contains approximately 4,500 words, has only about 400 words (say 10 per cent.) even indirectly referring to the subject of the paper—"Use of Bituminous Materials on Highways in 1911."

NOMENCLATURE.

The article "Highways of 1911," etc., opens with definitions of names entirely novel, designed to meet the commercial interests of the clients of the author and quite contrary to the following nomenclature adopted unanimously by the American Society of Municipal Improvements at its 1911 Grand Rapids convention, being the result of two years' deliberation of a committee of engineers of which the author was a member.

Bituminous concrete is a pavement consisting of a combination of broken stone and sand, or fine mineral matter, cemented together with a bituminous cement, and which has all its ingredients mechanically mixed before being laid. To be termed a bituminous concrete it must partake of the well-known characteristics of concrete, that is, there must be stone enough in the composition to form an important part thereof and add to its strength and durability; also there must be enough of the mortar constituent, that is, the sand and bituminous cement, to properly support and bond together the largest particles. It is normally a one-layer pavement, all parts of it having equal stability, due both to the structure of stone and the bond of the bituminous cement, and depending on the base for vertical support only. It may or may not be finished with a skim coat and top dressing of sand or stone chips. It is adapted to be laid on either a hydraulic concrete or macadam base, which may or may not have a light coat of bitumen to increase the adhesion.

In the paving mixture, gravel may wholly or in part be substituted for crushed stone, and fine crushed stone for sand. Mineral dust also may be added to increase the density and stability of the mixture.

Bituminous macadam is a pavement consisting principally of crushed stone, retains its integrity of structure mainly by the mutual support of the various particles of stone, aided by the slight bonding value of the fine mineral matter in its composition, and protected from surface disturbances by an upper bonding layer of bituminous material. It is a one-layer pavement, and there is no definite distinction to be made between the wearing surface and the base, as in their nature they must be knit together in one structure. Practically all the horizontal stability as well as vertical support is from the macadam base. The pavement may be produced by adding the bituminous top to the macadam base by either the penetration or the mixing method. In the former the bitumen is applied in a liquid state and a top dressing of stone or sand is spread over the surface and thoroly rolled. In the latter the bitumen is mixed with the mineral, consisting of comparatively fine stone or sand, or a mixture of both, and forced into the macadam body of the pavement by rolling. In either case, whether the penetration or mixing method is followed, the macadam base must be specially prepared, with voids in the upper portion into which the bitumen or bituminous mixture penetrates, leaving a coating of the desired thickness over the surface.

Paving nomenclature surely would be in a sad dilemma if every "expert" should adopt a system all his own, designed to meet the commercial interests of his clients, and endeavor, thru engineering papers and societies, to make such definitions appear as "standard." On this basis we would have as many "standard" definitions of names as we have "experts."

BITUMINOUS CONCRETE.

The paper "Highways in 1911," etc., says:

It has been claimed that a bituminous concrete containing as part of its mineral aggregate broken stone passing a ½-inch sieve and retained on a ¼-inch sieve should be classified under sheet asphalt pavements. Fortunately this assertion has not been received with favor by municipal engineers.

As the American Society of Municipal Improvements definition quoted above clearly shows, it is not necessarily the maximum size of mineral aggregate that determines whether a mixture of cement (either bituminous or hydraulic) aggregate is "mortar" or "concrete," but the ratio of proportions the coarser sizes bear to the finer sizes, and when the "mortar" only contains enough coarser particles to "swear by," it is still mortar. That the pavement referred to consisting of sand and "less than 10 per cent." material remaining on a ¼-inch screen opening is in reality an "asphalt sheet pavement" (asphaltic mortar) is best shown by the specifications of the city of Pittsburgh, where it originated, and where it was always specified as "asphalt pavement," and where the ¼-inch material mixed with the sand was merely the very little screened from the "open binder" course, which screenings would otherwise have been a waste, and which added nothing to the value of the sand mixture, and probably practically detracted nothing, altho theoretically, at least, they increase the tendency to shifting of the pavement surface, because the coarser particles of aggregate are not in approximate contact with other coarse particles, but just enveloped in plastic mortar—"a raft of stone in a sea of mortar," or, as otherwise expressed, "like fruit in a poorly fruitized fruit cake," which condition subjects the coarser particles to the greater leverage and rocking tendency of loads bearing on the individual particles.

RHODE ISLAND ROADS.

The writer of "Highways in 1911" refers, in general terms, to bituminous roads laid under his supervision, while connected with the Rhode Island State Highway Department in 1906 to 1909, and quotes, without using names, from a letter written by Warren Brothers Company to the Rhode Island State Highway Department, as follows:

So long as the construction is of the

nearly uniform sizes of stone which you are now using, and you do not get the fine material applied from the surface into the spaces between the particles of bitumen-coated stone more than our observations indicate you are now doing, or we believe it is possible to do, we would not claim this feature of the construction to be an infringement of our basic patent No. 727,-505.

This letter, written in 1910, referred to Rhode Island roads constructed in 1907 to 1909, inclusive, along certain low cost but unscientific lines which, wherever subjected to any considerable traffic, have practically failed and required extensive repairs and in many cases entire new covering.

The author of "Highways in 1911," referring to a pavement made of "one size crusher run stone," says that "during the past year" he "has seen excellent pavements constructed by this method." How can any expert certify to the excellence of any new form of pavement construction in use less than six months, the paper referred to having been written in the early months of 1912 and referred to work of the "past year"?

The writer would like to be shown a single roadway of the type referred to which has been subjected to even moderate traffic for a period of two years which is not very defective. He can show many such, which have utterly failed in one year's use under moderate traffic.

ENGLISH PRACTICE, 1899.

Reference is made to certain English specifications for bituminous pavements laid in layers of varying thickness, but each layer of uniform size, in use in 1899, similar to the Rhode Island practice above referred to. It is generally conceded that this construction has not been a success in England except under the lightest traffic conditions, and it has also failed in Hamilton and Toronto, Ont., Rock Island, Ill., Elmira, N. Y., St. Marys, Pa., and other points where it was thoroughly tried out during the years 1899 to 1902, inclusive.

GRADED AGGREGATES.

"Highways of 1911," etc., refers to "bituminous mixed pavements and combinations of one size crusher run stone and fine material matter, such as sand, stone screenings and fine gravel," and cites certain construction in Washington, D. C. The definition quoted above is indefinite, as heretofore shown under heading "nomenclature," more specifically referring to Pittsburgh; the relation of such construction to the Warren patents depends on the details of specifications or construction in each particular case. In order that the public may not be misled by the references to recently laid Washington, D. C., pavements, which, as "Highways in 1911," etc., says "possess inherent stability," the writer begs to state unequivocally that the Washington construction, although inferior in detail to the best practice, does infringe on the F. J. Warren basic patent 727,505, and has been so proved by decision of the United States Circuit Court of Appeals, Second Circuit, in Warren Brothers Company vs. New York City.

"Highways of 1911" indirectly "throws the gauntlet" as it has been previously and more directly thrown to Warren Brothers Company, with the question, "If Washington infringes, why not bring action for such infringement?" The simple answer is that it costs $40,000 or more to each side to bring such a patent suit to a final decision; that under the division of the Federal Courts a decision of the Court of Appeals of the District of Columbia covers the city of Washington only, and, at the slow rate Washington has been infringing during the past two years, it would take about ten years of the very modest royalty Warren Brothers Company charges for use of its patents to recover the expense of litigation, very little of which, as is well known, can be recovered in direct costs and damages in any specific case.

Warren Brothers Company has neither the financial ability nor the energy to pursue expensive, annoying patent litigation in all Federal Court districts at the same time, nor does it believe either its or the public interest would be best subserved by so doing, and it simply prefers to select its own time and forum for such expenditure in defense of its patents as its competitors desire to force, and to select judicial districts where results of favorable adjudication cover several States and are liable to be sufficient to warrant the expense. As to the city of Washington, as litigation there covers one city, and that one nearly fully paved, we prefer to "bide our time," and, if the accumulated infringement within the six years permitted by the patent laws is sufficient to warrant the expense, we will then, or at such meantime as we think best, bring such action as we may then think best. No amount of "throwing down the gauntlet" by competitors and their hired "experts" and attorneys will swerve us from this proper economic business policy, but in due course we expect to bring action against all municipalities and others which, during the brief time the patent franchise is granted by the government, see fit after due notice to use our patents without securing license for such use.

"ANTICIPATING" PUBLICATIONS.

"Highways in 1911" refers to a number of alleged anticipating patents and other publications, which its author well knows have been "threshed out" before the District Courts of Alabama and Kansas, and the Federal Circuit Courts of Appeals of the Sixth and Second Circuits have decided that the patent referred to is valid and in all such cases to be no anticipation, and

broadly defined, and that the United States Supreme Court, with full record and briefs before it, has denied petition of certiorari from the decisions of the Sixth Circuit Court of Appeals.

The author of "Highways in 1911," in an obscure statement fraught with absence of frankness, makes reference to a pavement "description so old as to be covered with the dust of decades," with absolutely nothing even tending toward proof that any pavement was ever constructed in accordance with the "description." When the writer first read the paper "Highways in 1911," etc., about a month ago, he wondered if it could be possible that any library had any such publication which had been overlooked in the most searching scrutiny made by the dozens of attorneys and experts on both sides of the Warren patent litigation, who, during the past ten years, have "raked over" all the old libraries to find any such publications. We did not have long to wait, for on June 28, 1912, at the close of the taking of depositions in protracted patent litigation, the author of "Highways in 1911," as "expert witness" for the defendant infringers, undertook, under oath, to identify as true a typewritten uncertified copy made by his subordinates of a book "the original of which was said to be in a public library," and published in 1871, containing the matter referred to in "Highways in 1911," as "covered with dust of decades," which "book" he claimed to have "discovered" in 1907. It took four hours of most labored cross-examination and the chagrin of witness and his counsel to bring out the following all-important facts, carefully kept back in both "Highways in 1911" and in the "less than half-told" sworn direct deposition of its author:

First—That the publication is not a "book," but a paper circular.

Second—That in the "copy" put in as evidence the order of the matter was distorted so as to give to it the apparent impression desired, which the original does not in fact contain.

Third—That there had been made a copy, certified by a notary, which was withheld from the deposition, and an uncertified copy presented as "evidence," apparently because the certified copy was a true copy and therefore would not serve the purpose of the "expert" and his client.

Fourth—That the only paragraph pertinent to the matter of patent anticipation (quite different in its purport from the balance of the "book"), which paragraph, quoted in "Highways in 1911," is a few lines taken from four pages pasted in the back of the "book," printed on paper different in both quality and size, and never a part of the original publication, and apparently surreptitiously attached thereto during some recent period.

Fifth—That the witness "has reason to believe" that another original copy of the book is in existence, the location of which he refused to divulge, apparently because it does not contain the important attached matter.

Following the cross-examination above referred to, it took an investigation of the original book to divulge that the "book" (paper-covered pamphlet) referred to is listed in the library as "fifteen pages," which is the exact number of pages of the original matter, thus further proving the fair inference that the important matter referred to has been secretly and recently attached to the original publication. The competitors of Warren Brothers Company are surely in a bad way when they have to resort to such means to attempt to tear down its business and patents, the successful development of which has required a decade of time, hundreds of thousands of capital, an immense amount of energy and thought and the untimely death of the inventor in overexertion of energy during its early development.

GEORGE C. WARREN, Boston, Mass.

Want Information About Tests of Sand for Concrete.

To the Editor of MUNICIPAL ENGINEERING:

Sir—The National Association of Cement Users, thru their committee on specifications and methods of tests for concrete materials, are investigating the problem of testing sand and other aggregates for use in Portland cement mortar and concrete to determine their suitability for such use. This committee desires to get into communication with all laboratories that are now testing sand and other aggregates, and to secure their co-operation with the committee in formulating standard tests for these materials. The committee is particularly anxious to secure samples of sand which appear suitable for use in concrete, but in practice prove unsuited. The committee would welcome communications from all interested in the subject who are willing to co-operate in this work to the extent of furnishing data obtained in their laboratory or field practice, or of recommending forms of tests which may be considered by the committee. Communications should be addressed to Cloyd M. Chapman, care of Westinghouse, Church, Kerr & Co., 10 Bridge street, New York.

COMMITTEE ON SPECIFICATIONS AND METHODS OF TESTS FOR CONCRETE MATERIALS.

Sanford E. Thompson, Chairman.
William B. Fuller.
R. S. Greenman.
Arthur N. Talbot.
Cloyd M. Chapman, Secretary.

Information may also be sent to MUNICIPAL ENGINEERING, Indianapolis, Ind.

MUNICIPAL MATTERS IN COURT

A Municipal Officer May Be Put Out of Office for Holding Stock in a Concern Selling to a Municipality.

Quo warranto proceedings were instituted against the burgess of the borough of East Pittsburg, to oust him from his office by reason of his alleged violation of the act of May 28, 1907, relating to borough officers. It was said that the defendant was the duly elected burgess of the borough of East Pittsburg; that he was, at and after the time of his election, interested in the Egan Plumbing and Constructing Company as stockholder and as manager; and that while he was burgess and so interested in the company, that company sold to the borough certain goods.

The answer of the defendant denied that he was financially interested in the Egan Plumbing and Constructing Company at the time of his election and at the time of the purchases alleged to have been made; admitted that the Egan Plumbing and Constructing Company did sell the goods in question, part of them for the use of the lock-up, the goods being purchased by the chief of police and the street commissioner, under circumstances requiring haste in the procurement thereof; and that the sales were made without his knowledge and against his order.

Upon the trial the jury found a special verdict, that at the time the purchases were made from the Egan Plumbing and Constructing Company defendant was president of it; and they further found that when the purchases were made he did not know of them until after the goods had been delivered and the work done, and had knowledge of them only when warrants were issued for the same and of the payment of the warrants, and that if upon this state of facts the court should be of opinion that the plaintiff was entitled to recover, then to find for the plaintiff, and otherwise to find for the defendant.

The act in question makes it unlawful for the burgess or other officers of a borough to be interested, either directly or indirectly, in any contract for supplies to be furnished for the borough, and for any burgess to be a member of any partnership, or stockholder and officer in any corporation, or agent or employe of any individual, partnership or corporation in any way interested in any contract for the sale and furnishing of any supplies for the borough, and provides that any person violating these provisions or any of them, shall forfeit his office.

There were a number of small sales at different times, as admitted by the defendant in his pleadings, and he knew of them when warrants were drawn for their payment, and knew of the payment of the warrants, and altho it is not so found in the special verdict, it appeared from the evidence that he indorsed these warrants himself as president of the company. These facts were held to show, not a repudiation of the contracts when they came to his knowledge, but an adoption of them. It has been frequently held that the amount involved in such cases makes no difference, and that the intention of the party is also immaterial. The act makes certain relations between the officer and the borough unlawful without reference to whether they are knowingly or corruptly entered into, and the legislature has undoubted power to make such a provision, as the deprivation of an office of this kind does not affect the liberty or property of the official.

It was, therefore, ordered that judgment be entered on the verdict for the plaintiff, and that the defendant, Fred W. Egan, be ousted from office of burgess of the borough of East Pittsburg, 234 Pa. S. C. R. 24.

To Prevent Stream Pollution by Pennsylvania Municipalities.

Suits which have been inaugurated by the attorney general's department against the boroughs of Tarentum and Greenville, in western Pennsylvania, for ignoring the decrees of the state that they cease discharging sewage into streams without preliminary purification are but the commencement of a series of actions by the commonwealth for recovery of damages from a number of municipalities. No less than ten cities and towns are said to have been warned to obey the mandates of the authorities or take the consequences.

The act of 1905 provides for penalties of

$500 fine and $50 for each day the decree is disregarded, and at the office of the attorney general it is stated that clear violations of the terms of the decrees signed by the governor, attorney general and commissioner of health have been found against Greenville and its sister borough. The act has been sustained by the appellate courts on appeals from eastern counties, and the suits started against the towns were started only after repeated warnings. It is contended by state officials that vigorous steps must be taken to demonstrate that the commonwealth intends to enforce the purity of streams in view of the increasing population and the demands for pure water supplies.

Electric Company Must Adopt Kind of Pavement Chosen by City.

A second decision has been given by Judge Eschweiler, affirming a former decision by Judge Ludwig, which held that The Electric Company of Milwaukee should be compelled to lay asphalt between its car tracks. The city recently laid asphalt pavements on the streets in question and the street car company wished to retain its wooden blocks.

Decisions of the Higher Courts of Interest to Municipalities.

Contractor Liable for Damage Due to Disregard of Plans Upon Which a City Permit is Issued.—While an employer is liable for the negligence of an independent contractor where the thing contracted for is a nuisance or dangerous per se, the construction of a tunnel excavation across a street according to plans which kept the tunnel eight feet from a water main, which was broken by negligently changing the course of the excavation by the contractor, was not a nuisance or dangerous per se, so as to make the one contracting with the independent contractor liable for the latter's negligence in running the tunnel into it. Von Lengerke et al. v. City of New York et al. (N. Y.) 134 N. Y. S. 832.

Delayed Estimates Not Grounds for Breaking Contract if Previous Estimates Have Been Accepted Even Though Late.—A contract with a city provided for monthly estimates of the work done and materials furnished, and for the payment by the city to the contractor of 95 per cent. of each estimate, but fixed no time for such payment. Payment of May and June estimates was accepted by the contractor in September, and of July and August estimates on a later day in September. Upon the nonpayment of September, October, and November estimates, the contractor after a peremptory demand for payment of all the money due within three days elected to rescind and sue on quantum meruit. Held, the acceptance of payment on former estimates without objection after delay established a course of dealing from which the contractor could not depart without reasonable notice, and the continuance of the custom was not a breach which would entitle him to abandon the contract. Cranford Co. v. City of New York (N. Y.) 134 N. Y. S. 839.

State Supreme Court May Appoint Appraisers to Condemn Public Utility.—A federal District Court will not temporarily enjoin proceedings under an appointment by the state supreme court of appraisers in proceedings by a city to condemn a waterworks plant, on the ground that an act authorizing the appointment is unconstitutional, where the state supreme court has not passed upon the validity of the act, except by acting under it, where there is a conflict in authority on the question involved, and the state supreme court could find ground sustaining the act. Des Moines Water Co. v. City of Des Moines (Ia.) 194 F. R. 557.

Furnishing Gas Outside of City Limits Does Not Provide Grounds for Rescinding Franchise.—In an action by a city to forfeit a gas company's franchise, allegations in the petition that the company had been furnishing gas to persons and corporations outside of the city ever since it acquired its franchise, which provided that no gas should be so furnished, were too vague and indefinite to sustain a forfeiture.—City of Newport v. Municipal Light Co. (Ky.) 145 S. W. R. 1108.

A City Cannot Bring Action Against a Municipal Gas Company for the Benefit of Inhabitants Who Are Overcharged.—A city which granted a municipal gas company a franchise, in consideration that it should furnish gas to the inhabitants at a stipulated rate, cannot maintain an action against the gas company for the benefit of the inhabitants who have been overcharged; for, while the statutes require every action to be prosecuted in the name of the real party in interest, except as provided in a section which allows a person in whose name a contract is made, for the benefit of another, to bring an action without joining him, the person for whose benefit it is prosecuted, the contract in this case is in the name of the city for its own benefit, and for the benefit of the consumer. City of Newport v. Municipal Light Co. (Ky.) 1450 W. R. 1108.

Water Company Must Bear Cost of Service Connections.—Requiring a water company, upon the theory of an implied contract, to bear the cost of making the service connections which it was its duty, under its charter, to make, does not amount to confiscation and the consequent taking of the company's property without due process of law.—Consumers Company Limited plff. in err. v. Albert L. Hatch, 32 Su. Co. R. 465.

A Municipality Has No Authority to Compel a Street Railroad to Light Its Road or Bridges—A municipal corporation has no authority to compel an interurban or street railroad company to light its bridge or railroad within the limits of such corporation. Ohio Electric Ry. Co. v. Village of Ottawa, (O.) 97 N. E. R. 835.

MOTOR VEHICLES

Inquiry Into Fire Engine Trust.

The Department of Justice is reported to be investigating the large manufacturers of fire apparatus in the United States, with the object of ascertaining if a fire engine trust exists.

Many complaints, it is said, have been received in Washington, principally from municipalities over the country, in which it has been declared that there appears to be such a monopoly operating in restraint of trade in defiance of the Sherman law.

The inquiry, it is said, has assumed a nation-wide scope, and a force of special agents has been at work several months gathering data.

Three large concerns dealing in fire-fighting apparatus facilities, it is reported, are especially under the scrutiny of the federal authorities.

The principal organization is said to be the American La France Fire Engine Company, which has its headquarters in Elmira, N. Y., and operates six branch houses throughout the United States. The Chicago branch is located at 815 South Wabash avenue. Other branches are maintained at Cincinnati, Atlanta, Ga., San Francisco, Boston and New York.

A concern in St. Paul and another fire apparatus establishment in New York State are also being investigated in efforts to learn if they are combined in the field to control the market.

Chief Charles F. Seyferlich, of the Chicago fire department, in an interview quoted in the Chicago Evening Post, mentions the remarkable coincidence regarding recent bids received for furnishing the city additional fire engines.

"Last May," said the chief, "the city let a contract for three fire engines. The price quoted by three different companies, the American La France Fire Engine Company, the Ahrens-Fox Company, of Cincinnati, and the Nott Company, of Minneapolis, was precisely the same. The price was $5,975 for each of the engines, and there was not one dollar's variation. Again, the year before we called for bids for engines. The same three companies were bidding. There was a variation in price at that time of only $25. The second bidder's price was $10 higher than the lowest one, and then the third bidder was $15 higher than the middle one.

Motor Apparatus Has Street Rights.

While responding to an alarm, a motor fire truck which had been recently purchased by Richmond, Ind., struck and killed a citizen, Isaac Parry. The car was being driven at about twenty-five miles an hour by a representative of the company which sold the car to the city.

A coroner's inquest which was held during the succeeding week developed the following points. The car was being driven at about twenty-five miles an hour, which is not considered an unreasonable speed for motor fire apparatus. On turning a corner a crowd of sightseers gathered to watch the apparatus pass, and a vehicle in the road caused the driver to turn quickly, resulting in the skidding of the car and the striking and killing of Isaac Parry.

The coroner's investigation was unusually thoro, as possible law suits might require the use of the information developed. The testimony of members of the fire department, the truck driver, Homer Hammond, president of the board of works, and spectators constitute the report, which covers thirty-four pages.

In the coroner's report it was neld that no account need be taken of the speed of the truck in answering the call which indirectly led to the death of Parry. "Tho the speed were twice as great as it was," the coroner holds, "no account need be taken of the speed of the truck, it being assumed that the fire department has the right of way and that the streets are cleared, and in this case an attempt had been made by the police to clear the street so that the vehicles of the fire department might pass."

All Motor Apparatus in the Passaic (N. J.) Fire Department.

The city of Passaic, N. J., has set an example for municipal progressiveness which would be a credit to a much larger community.

Recently the last horse in its fire department was sold, and now eleven pieces of motor apparatus comprise the city's fire fighting equipment. The latest purchase was a combination hose and chemical wagon.

Fire Chief R. H. Bowker, in discussing the value of motors compared with horses, stated that the machines will entirely pay for themselves in less than four years, owing to the saving in expense of feed, shoeing and large space required for the horse stalls and equipment.

Other cities in the vicinity of Passaic that will eliminate horses from their fire departments are New Rochelle, Yonkers, Stamford, Newark, Paterson, Mount Vernon and, last New York City.

The Motor Truck for Haulage and Transportation.

A prime factor in bringing about underproduction and over-consumption, of which so much is being said at present, is the large number of horses used for haulage and transportation purposes, when the advent and efficient development of the motor truck would seem to indicate no real need for their presence.

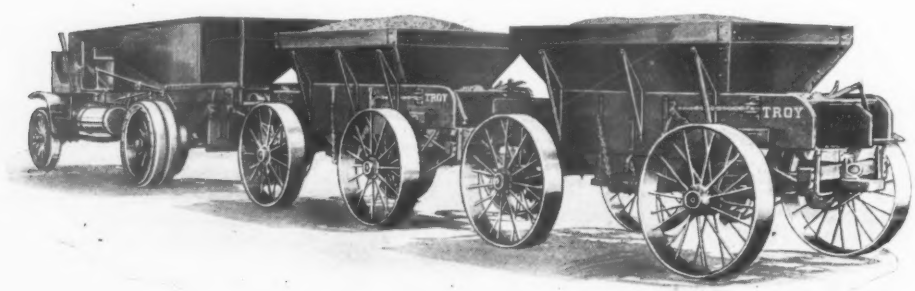
The advent of the motor truck has brought about a new era of transportation. The percentage of shrinkage in horse-drawn vehicles in Chicago during the past year amounted to 15.7 per cent. for one-horse wagons and 13.5 per cent. for two-horse wagons. The aggregate shinkage is 14.6 per cent. for the year. Altogether 6,753 horse-drawn vehicles were discarded in Chicago between May 1, 1911, and May 1, 1912. Since a motor truck handles tonnage equivalent to that of three two-horse wagons the saving in time, money and congestion of traffic becomes very great.

The contractor on all classes of work is coming to understand and appreciate the economy of the motor truck. Particularly is this true in road building where the nature of the work and the length of haul are so well adapted to the economical use of the motor truck. The photograph given herewith shows a 6-ton motor truck pulling two trailers of 3 yards capacity each to haul road material.

Both truck and trailers are fitted with special quick-dumping bodies to facilitate delivery. Two of these road trains hauled by Knox trucks have been in active service in Sioux City, Ia., for the past year and have made a remarkable record in road building, having delivered an average of 44¼ yards of material per day, a distance of 3½ miles, during a busy season.

The contractors who use this method of hauling road material estimate that it would have required over 10 two-horse teams to do this amount of work, while the cost by horses would have been over twice as much.

Grades varying from 3 to 7½ per cent. were negotiated without difficulty, and while the practice of hauling such heavy loads by this method on grades puts an unreasonable strain upon a motor truck and is therefore not sanctioned by truck manufacturers, it nevertheless illustrates the great ability of motor trucks under these circumstances.



MOTOR TRUCK AND CARS ON ROAD WORK.

The Proper Training of Motor Truck Drivers.

As one of the first companies to manufacture motor trucks, the Knox Automobile Company, Springfield, Mass., early appreciated the importance of carefully training the men who were to operate the vehicles, and for this purpose adopted a thorough system which has been productive of excellent results from the standpoint of both the company and its patrons.

The length of the course given depends upon the amount of time permitted the men by their respective companies or cities, as the case may be, but the most satisfactory arrangement is for the men to follow the assembly of their cars right thru the factory, beginning with the motor and ending with driving instruction during the rough test of the chassis.

This course enables the men to become familiar with the various parts of the cars in minute detail, as well as teaching them practically all of the essential adjustments, etc., necessary for satisfactory results, so

that they feel a larger measure of confidence and can give intelligent thought to the care and maintenance of the expensive machinery.

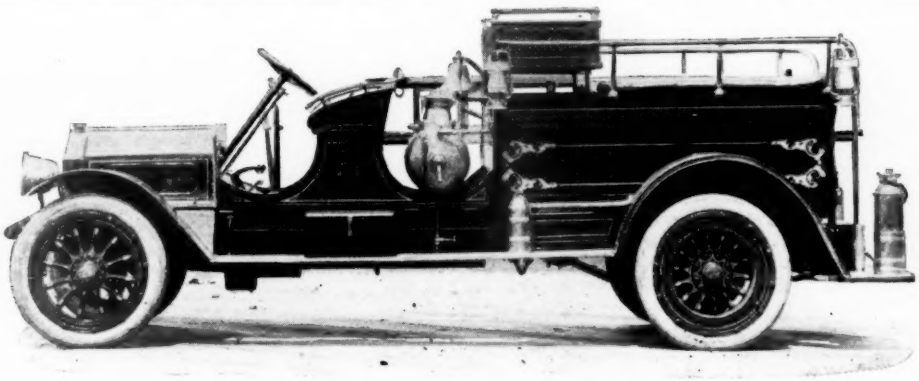
No city can afford to spend from $3,000 to $10,000 for a modern motor truck and put it in the hands of an ignorant, half-trained driver to abuse and ruin in a short time, and the systematic method of instruction outlined above is of immeasurable benefit to the purchaser of a motor truck.

Additions to New York City's Motor Fire Equipment.

Four combination chemical and hose cars have recently been added to the New York Fire Department. The accompanying photograph shows one of these cars as ready for service.

The engine is built on a 2-ton chassis of the Mack truck type, which is equipped with a steel body, with a hose reel capacity of 1,000 feet of 2½-in. fire hose. The body is constructed of standard hose body type construction with flared sides and seats for the accomodation of the firemen. The chemical tank has a capacity of 30 to 40 gallons and is equipped with Lally quick opening and self-packing tops. The chemical hose basket is arranged to carry 200 feet of special 4-ply hose. Hand rails are provided running from rear of drivers seat to back step. The fire extinguisher equipment consists of two to three-gallon break-bottle type mounted in polished brass holders on the rear step. Two heavy duck soda bags are also provided.

The lighting is by means of two 8-in. head lights mounted on front springs together with two side oil lamps on each side of the driver's seat. The electric head light is provided with current from 60-hour ampere storage battery. The conventional locomotive bell is mounted on the dash. The usual complement of firemen's axes, acid receptacle holders, etc., are provided, together with tool boxes, a 12-foot roof ladder and a 20-foot extension ladder.



COMBINATION CHEMICAL AND HOSE CAR,
New York Fire Department.

Definitions of Motor Apparatus.

Confusion often arises in descriptions of different types of motor fire apparatus, particularly among newspapers and popular periodicals, which mention specific kinds of automobile apparatus in general and indefinite terms. A number of definitions of the types of apparatus have come into general use, and by this use have become standard. The types defined are:

Motor Fire Engine, a straight pumping engine without any provisions for carrying fire hose.

Motor Chemical Engine, a straight chemical engine with one or more chemical tanks, chemical hose, etc., but with no provision for carrying fire hose.

Motor Hose Car, a motor-driven hose wagon for the carrying of standard fire hose. Often made with a capacity of from 1,000 to 3,000 feet of hose.

Motor Fire Engine and Hose Car, which consists of a straight pumping engine, provided with a body with a capacity to carry 800 to 1,500 feet of fire hose.

Motor Combination Chemical and Hose Car, a combination of such chemical equipment as may be specified, with a body capable of carrying 800 to 1,500 feet of standard fire hose.

Motor Triple Combination Fire Engine, Chemical and Hose Cart, a combination of such chemical pieces of apparatus, viz.: pumping engine, chemical engine and a body carrying whatever amount of fire hose is specified.

Motor Aerial Hook and Ladder Truck, an automatic or manual quick-raising aerial ladder, mounted on a motor-driven chassis.

Motor Service Hook and Ladder Truck, is, as its name implies, the equipment of ladders usually carried on old horse-drawn hook-and-ladder trucks, with fire apparatus usually a part of same, except that this is mounted on a motor-driven chassis.

Motor Chief's Car, a chief's automobile,

which may be equipped with one or more chemical tanks and other emergency apparatus.

Motor Squad Wagon, a motor-driven wagon capable of carrying six or more men. May be equipped with one or more chemical tanks and provision made to carry such other equipment as may be required.

A Motor Street Sprinkler.

The city of Pensacola, Fla., is using for sprinkling its streets a motor sprinkling car comprising a cylindrical tank holding 450 gallons, mounted on a commercial chassis of 3,000 pounds capacity. The car is designed to do the work of several horse-drawn sprinkling carts, at a great saving of time and labor. The amount of water spread over the road is regulated by the driver by means of levers, at the driver's seat. One great advantage of the motor sprinkling car is said to be that it does not puddle the roads the way the ordinary slow-moving carts do, but wets the ground thoroly while traversing the route in less time than the horse-drawn vehicle.

The chairman of the Board of Public Works of Pensacola is well pleased with the operation of the car, and comments upon it as follows:

Previously we ran two 500-gallon two-mule team sprinklers, and did not secure the service we required, and we had to be always careful not to overheat the mules. After a very careful investigation I put the matter up before my board, with the result of getting an automobile sprinkler, and after running for several months in a gas car, without any adjusting and with the meager instruction I gave him, we find the service far beyond what we ever expected. It covers all the territory of the other wagons, and a great deal more, and the cost of running is so little in comparison that we feel that it has been a most judicious investment. I would say, also, that besides this regular work it is used many times at night on extra work in sweeping and cleaning the streets.

Scranton Council Reports on Paving Investigation.

In response to agitation started in a local newspaper the city council of Scranton, Pa., instituted an investigation of paving conditions in the city. The inquiry has been in progress since October, 1911, and a report was not prepared until July 12, 1912. The report, as briefly summarized, states the following recommendations:

First: That the contracts and specifications in use at the present time for pavements, which are in many respects old and not in accordance with the best modern practices, be revised. Among other things, by striking out the private brand names of paving materials to be used, and providing for chemical tests and requirements, that all bidders and contractors will know exactly what quality of material may be used and how the same are to be put together. This will also enable the city officials to make definite tests for the purpose of ascertaining whether or not the material being used meets the requirements of the specifications.

Second: That at the time proposals are received from contractors, samples of materials proposed to be used should be submitted with the proposals for the purpose of analysis, and that during the construction of the work, at short intervals, analyses be made of materials being used and the report of such analyses placed on record with the proper city officials.

Third: That inspectors be furnished with details, written or printed instructions, regarding their duties as inspectors of paving constructions, also with simple special forms upon which to make daily reports.

Fourth: That instead of the present method of general repairs twice each year, and a few at irregular intervals hereafter, a system be established for the constant prompt repairs of all kinds of pavement at all times, weather permitting. This, in our opinion, would effect a saving in expense, and the pavements would be substantially in constant good order at all times.

An Original Street Flushing Machine.

To clean the paved streets of Baker, Ore., Anderson Finley, commissioner No. 2, has constructed a machine on the flushing system, with a water pressure of from 60 to 90 pounds.

The machine is composed of sections of 2-inch pipe, 10 or 12 feet long, mounted on 8-inch cast wheels, joined together by pieces of 2½-inch fire hose, about 3 feet long. The axles are made of ¾-inch galvanized pipe, 27 inches long, which are fastened rigidly by means of clamps thru the axles and fifth wheel arrangement to the 2-inch pipe, about 18 inches from the end, the ends of the 2-inch pipe being slightly swelled to prevent the hose from pulling off when slipped over the pipe, and well wrapped with No. 6 wire.

The machine can be made any length desired, the length depending on the distance between the fire plugs.

At the end where the horse is fastened the pipe is clamped to the axle at a right angle to the main line. The front axle is 32 inches long, which makes an offset for the horse to work by the side of the nozzle section. The end of this offset pipe is supplied with an elbow and short nipple, which stands up perpendicularly. This, in turn, is connected with the nozzle section with a 1½-inch Holland flexible joint, which makes it possible to turn the nozzle in any direction.

The nozzle is a piece of ¾-inch pipe, slightly flattened at the end so as to throw the water in a sort of broom-shaped spray, thus avoiding the wearing effect of a solid stream on the pavement.

The connecting end of the machine is supplied with about 9 feet of hose and a 2½-inch coupling.

STREET LIGHTING

Ornamental Street Lighting in Fargo, N. D.

Fargo, N. D., started in 1909 to slowly establish an ornamental lighting system. At the start the property owners along the streets paid for the posts and installation and the tenants paid for the current at the rate of 25 cents per front foot. In 1910 the city took over and paid all the maintenance and current charges.

The posts are of cast iron, and consist of a base and a column supporting four bracket arms, from which ball globes are suspended in an inverted position, and a center ball globe held upright on an ornamental cap.

All lamps burn until midnight, when the four smaller ones are turned off, leaving the upper lamp burning until dawn. The city has ordered the removal of all arc lamps in the district served by these ornamental posts, as it was found that they were not only unnecessary, but by contrast were unsightly.

The Fargo "White Way" is an instance of the value of a good example. From a few ornamental standards established in the downtown section, the spread was rapid into other portions. The possession of the ornamental lights by a few merchants led to a kind of pride in the others, so that they installed the standards in order to "keep up" with their neighbors. Tho installed in this piecemeal manner, the standards adopted were uniform and the effect of the entire system is very pleasing indeed.

Chicago Starts City Beautiful Project.

The first step for the realization of the "city beautiful" project, known as the "Chicago plan," was taken by the city council on July 23, when an ordinance appropriating $1,750,000 to meet the city's share of the expense in widening Twelfth street, from Michigan to Ashland boulevards, was passed by a vote of 49 to 13.

Under the provisions of the ordinance the magnificent boulevard, with an ornamental bascule bridge over the river, to cost in the neighborhood of $500,000, will be the initial link in the Chicago plan, and will form the south quadrangle of this great improvement. The expense of the new bridge will be borne jointly by the city of Chicago and the sanitary district.

The $1,750,000 voted by the city council is estimated to be about 50 per cent. of the total cost of the improvement, exclusive of the new bridge. Property owners whose real estate holdings will be benefitted by the improvement are to pay the balance in special assessments. The city's contribution of 50 per cent. is given because of the public benefits to accrue from the improvement.

Ellsworth, Kans., Rents Its Sewer System.

When Ellsworth was "hard up" several years ago, and needed a sewer system badly, Edward Wellington, a wealthy resident, offered to build a complete sewer system and rent it to the city until the city was able to buy it. A contract was entered into and a fine sewer system was built, the city paying rent on a yard basis. The original contract has now run out, but both sides are so well satisfied that a new contract has been entered into, the city continuing the yard rental system and Mr. Wellington building additions as fast as they are needed. Under the system the city is said to be saving money that would have been paid out in interest on bonds and Mr. Wellington is making a good profit on his investment.

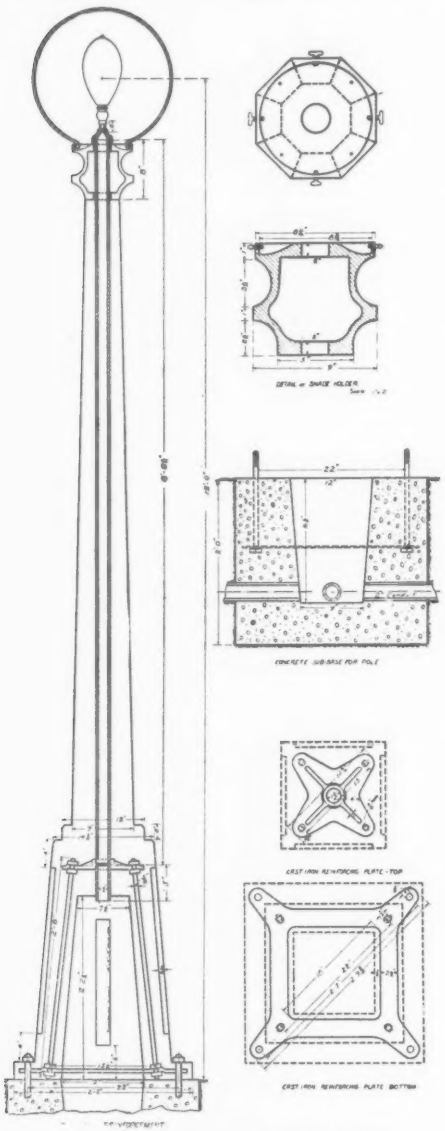
Concrete Lamp Posts in Seattle, Wash.

H. L. Quigley, of Seattle, Wash., describes, in a recent issue of *Pacific Builder and Engineer*, a new type of concrete posts which has been adopted by the University of Washington, at Seattle. Concrete ornamental lighting standards have come into use in a number of cities, among which are Richmond, Ind., Terre Haute, Ind., Oklahoma City, Okla., Rochester, N. Y., Riverside, Cal., and Chicago, Ill.

The last two mentioned are perhaps the more widely known instances. In Riverside a very unique design, which is in character with the city, has been adopted. The post is of reinforced concrete, and consists of an ample base, a shaft and a capital, made in imitation of the bell posts of the old Franciscan monks, and resembling somewhat the

Greek letter Pi, superimposed on a horizontal arm. The posts support three electric incandescent lamps.

The lake shore drive lighting system of Chicago has been described in these pages. It consists of simple standards of artistic



DETAILS OF SEATTLE CONCRETE LAMP POST.

design, supporting single ball globe lights. They are finished, as in the case of the Seattle standards, by the action of acid bath removing the cement from between the particles of bright gravel. The Rochester standard is similar in that it is a simple standard, with an ornamental capital supporting a ball globe lamp.

The description of the University of Washington standards, as given by Mr. Quigley, is briefly as follows:

At present seventy-eight posts cover the most important parts of the campus, or about one-fifth of its total area. The system will be enlarged and completed when possible by a further state appropriation. Throughout the work represented in these concrete posts the idea of "Washington" has been carried out. The design was by a University of Washington instructor, the entire labor was furnished by student engineers during their vacations, and the castings necessary were designed and made at their foundry.

The concrete was hand-mixed in proportion of two parts cement to five parts gravel, without the use of any sand. The pea gravel was hand-screened through a three-to-the-inch mesh, and all of the under size caught on another screen of six meshes to the inch was used. Wooden forms were used, and the posts were poured with the forms set vertically.

After an average time of eighteen hours from the completion of the pouring, the molds were removed and the surface thoroly wire-brushed. After a three days' set, the surface was then given a one-half strength muriatic acid (commercial) bath. When the cement was eaten down sufficiently to make the gravel stand out prominently, the pole was liberally sprinkled with a hose.

Each sub-base and the necessary wiring for each lamp were completed prior to the arrival of the finished pole at its permanent location. By reference to the plan it will be evident that the construction enables easy and quick work on the electrical connections, without detracting from the beauty of design. The erecting frame and wagon were made at the university shops. The trucks support a weight of sufficient magnitude to require special construction.

The university power house generates and transmits current at 2,300 volts to the center of the manholes and subway type transformers, where it is stepped down to 225 volts at the lamp base. On the majority of the poles 100-candle-power Colonial Mazda lamps, with 20-inch sand-blast finish globes, are installed. These lights carry a voltage of 17.9, and in addition a few 200-candle-power lamps carry a voltage of 35.9.

A handhole in the concrete base is located on the opposite side from the passing pedestrian, and the three corresponding or symmetrical panels are of concrete, but painted black for harmony. A rich cement finish containing lamp black was experimentally used for this purpose.

The appended costs have not been completely segregated, and slightly higher costs would prevail if the lamp posts were made under contract, nevertheless the advantages of the concrete pole are prominent.

Bare pole	$14.50
(Pea gravel, $2.80 yard. Cement, $2.65 bbl.)	
Average cost of erection, including horse	.80
Pole foundation and anchors	6.00
Pole trimmings, lamp, globe, transformers, etc.	16.20
Labor, wiring pole, placing lamp, leveling, etc.	1.00
Cost per pole	$38.50

It is likely that the further construction of concrete lamp posts will come into prominence, especially in the high-class residence districts of Seattle.

ORGANIZATIONS & INDIVIDUALS

The Good Roads Year Book.

The official Goods Roads Year Book, which has just been issued by the American Association for Highway Improvement, is the most complete volume of information on he general question of good roads that has been prepared. Starting with a general synopsis of the history of road building, it brings the subject down to the particular needs and conditions in America, and all information extant upon the subject of good roads is either given in this volume or so referenced that it is placed within the reach of the seeker.

A few pages in the fore part of the book are devoted to the American Association for Highway Improvement, together with its aims, its members and it work. This section is followed by a general digest of road legislation thruout the country, each State being taken in turn and complete data being given on its laws relating to roads.

Then follows a full discussion of all of the types of roads known, with the best practice noted in each case. Bridges, culverts and other water crossings are then discussed in their relation to highway construction. The latter portion of the book is devoted to bond issues and funds available for road work in each State, road officials, manufacturers, educational institutions, contractors, patents pertaining to roads, and a complete bibliography of roads.

Viewed from any standpoint, the book is of value as a reference work to anyone interested in any phase of road building. It is the bible of the religion of good roads.

Preparations for the American Road Congress.

The first campaign meeting of Governor Wilson, of New Jersey, and President Taft is to take place at Atlantic City at the American Road Congress, between September 30 and October 5. The respective candidates of the Democratic and Republican parties have both consented to address the American Road Congress, and while the addresses of the two men will be non-political, there is great interest in the manner in which they will greet each other.

The American Road Congress marks the combination of the conventions of the American Association for Highway Improvement, the American Automobile Association and the National Association of Road Machinery and Material Manufacturers. It will be the first time that every faction engaged in the road movement has combined in one general congress. More than a half hundred state, county and local associations which are affiliated with the American Association for Highway Improvement will be represented at the congress, and automobile tours to Atlantic City from all sections of the country are being arranged by the American Automobile Association. Eighty thousand square feet of space have been set aside for the exhibits, nearly one-half of which has already been engaged by leading manufacturers.

The International Road Congress of 1913.

The Third International Road Congress will be held in London from Monday, June 23, to Saturday, June 28, 1913. These congresses will in future be held triennially. The first was held in Paris in 1908 and the second in Brussels in 1910. Their object is to collect, discuss and circulate all the latest practical and scientific knowledge with regard to the construction and maintenance of highways. The congress of 1913 is held on the invitation of the British government, and is under the patronage of his Majesty, King George V. The honorary presidents of the congress are the Right Hon. the Chancellor of the Exchequer and other members of his Majesty's government, and the vice presidents include the Right Hon. the Lord Mayor of London, members of both houses of Parliament, chairmen of county councils, mayors of cities and boroughs, presidents of learned societies and of associations of local authorities, engineers, automobilists, cyclists, and of other organizations interested in the improvement of the roads. Over thirty governments have intimated to the British Minister of Foreign Affairs their intention of taking part officially in the congress.

The congress of next year will receive and consider a number of papers and reports by the leading authorities throughout the world on the maintenance of roads, their founda-

tions and proper drainage, the prevention of dust and mud, the laying of light railways and tramways on roads, the choice of surfacing materials, the influence of weight and speed of vehicles on roads and bridges, the conditions that should be filled by horse or mechanically propelled vehicles in order that they may not damage or suffer damage from the roads, etc. Mr. W. Rees Jeffreys, secretary of the British Road Board, is honorary secretary.

Annual Convention of the American Society of Civil Engineers.

The forty-fourth annual convention of the American Society of Civil Engineers was held in Seattle, Wash., on June 25-28, with a registration of about 250. The addresses of welcome were delivered by George A. Lee, of Olympia, representing Governor M. E. Hay; George F. Cotterill, mayor of Seattle, and J. W. Spangler, secretary of the Seattle Clearing House Association.

The forenoons during the convention were devoted to business meetings and pleasure trips were arranged for the afternoons and evenings, during which excursions were made to the Puget Sound navy yard, Brown's Bay logging camp, Mt. Rainier, the Nisqually glacier, and several of the points of engineering interest in and near Seattle.

No reports by committees were made, with the exception of the committee on public utilities, which reported progress.

A paper was read by William Mulholland on the Los Angeles aqueduct; there was an illustrated paper on Pacific coast harbors, presented by Brig.-Gen. H. M. Chittenden, with a discussion of it by Major J. J. Morrow; an illustrated address on irrigation was made by F. W. Newell, director of the Reclamation Service. A paper entitled "Economies in Water and Design of Works Possible by Avoidance of Excessive Seepage Losses" was presented by E. G. Hopson, supervising engineer, U. S. Reclamation Service. A lecture, with lantern slide views of Alaska, was given by Maurice D. Leekey, and one on Mt. Rainier by Asahel Curtis.

The Union of Canadian Municipalities.

The following list of papers has been prepared for the twelfth annual convention of the Union of Canadian Municipalities, to be held at Windsor, August 27-29. Point Grey, B. C., Councillor Richardson, "Point Grey as a Model City; Vancouver, B. C., Alderman Hepburn, "Municipal Taxation;" Lethbridge, Alta., City Engineer A. C. D. Blanchard, subject not given; Edmonton, Alta., Alderman Clarke, "Equable Municipal Taxation;" Calgary, Alta., Mayor Mitchell, subject not given; Medicine Hat, Alta., Mayor Spencer, "Good Roads, and Their Effect on Rural Life and Transportation;" Regina, Sask., J. N. Bayne, deputy municipal commissioner, "Municipal Progress in the West;" Winnipeg, Man., Controller Harvey, "The Price of Cement," Controller Cockburn, "Winnipeg's Hydro-Electric Power Plant;" Detroit, Mich., G. A. Walters, secretary of police department, "Moving Picture Shows;" Toronto, Ont., S. Morley Wickett, Ph. D., "Municipal Government by Commission;" Ottawa, Ont., Mayor Hopewell, "The Georgian Bay Canal, and Its Water Powers;" Montreal, Que., Alderman Boyd, "Metropolitan Parks;" Sherbrooke, Que., Mayor Herbert, "The Operation of Public Utilities in Sherbrooke;" Quebec, Que., Alderman Cannon, LLL., K. C., "Electric Franchises;" Moncton, N. B., ex-Mayor Reilly, "Natural Gas in Moncton and Vicinity;" Halifax, N. S., Alderman Harris, "Capital Cities;" City Engineer F. W. W. Doane, "The Cleaning of Water Mains."

Plans for Cement Shows Changed.

Pittsburgh and Chicago will have the cement shows for the next season, and New York and Kansas City will be omitted. Announcements to this effect have been issued by the Cement Products Exhibition Company, 72 West Adams street, Chicago.

The date set for the first Pittsburgh cement show is December 12 to 18, 1912; the show will be held in Exposition Hall, Duquesne Way, Pittsburgh. The annual Chicago exposition will be held as before in the big Coliseum, where the recent Republican national convention was held. The date for the Chicago show has been set for January 16 to 23, 1913.

With the information as to the cement shows comes also the announcement that the ninth annual convention of the National Association of Cement Users will be held in Pittsburgh in December in connection with the show. The selection of Pittsburgh for a show and the abandonment of New York was based upon the desire of the management to hold a show in a new territory.

Technical Schools.

Jacob Joharn, of Springfield, Ill.,, for many years identified with the Illinois Central railway, and for many years an active member of the American Railway Master Mechanics' Association, has presented to the library of the University of Illinois a complete file of the Proceedings of the American Railway Master Mechanics' Association and a collection of miscellaneous volumes of interest to the Department of Railway Engineering.

George H. Benzenberg, consulting engineer, of Milwaukee, Wis., and past-president of the American Society of Civil Engineers, received the honorary degree of doctor of engineering from the University of Michigan at the annual commencement on June 27. Cornelius Donovan, principal assistant engineer in the U. S. Engineer Office at New Orleans, La., also received the degree of doctor of engineering.

Prof. H. S. Philbrick, M. Am. Soc. M. E., formerly Assistant Professor of Mechanical

Engineering at the University of Missouri, has been appointed Professor of Mechanical Engineering at Northwestern University, Evanston, Ill.

O. H. Landreth, M. Am. Soc. C. E., Professor of Civil Engineering at Union College, Schenectady, N. Y., and a consulting engineer of New York city, has been appointed to prepare plans and specifications for systems of water supply and purification, sewerage and sewage disposal, street and pavement construction, etc., for the Kawasaki plant of the Tokio Electric Co., of Tokio, Japan.

Technical Associations.

At the annual meeting of the American Society for the Promotion of Engineering Education, held in Boston on June 28, Prof. William T. Magruder, of Ohio State University, was elected president; Profs. L. S. Marks, of Harvard University, and F. W. Sperr, of the Michigan College of Mines, vice presidents; Prof. H. H. Norris, of Cornell University, secretary, and W. O. Wiley, of New York, treasurer.

The following officers were elected by the New York State Association of Fire Chiefs, held in Albany, on June 21: President, John Mack, Glens Falls; vice president, William Bridgeford, Albany; secretary-treasurer, Henry R. Yates, Schenectady.

A town-planning congress was held in connection with the Royal Exhibition of Winnipeg during the middle of July. Among the speakers of note were the following: H. R. H., the Duke of Connaught, on "Housing and What It Means to the Community;" F. L. Olmstead, of Brooklyn, N. Y., on "The Four Cardinal Points of Town Planning;" Mrs. Franklin P. Iams, on "The Housing Question;" Guy Wilfrid Hyler, on "The Essential Elements of City Planning;" Dr. Seymour, medical health officer for Regina, with Dr. Hodgetts, medical officer of the committtee of conservation at Ottawa, dealt with the "Tenement House Question and the Prevention and Eradication of Slums;" Mrs. Albion B. Fellows spoke on "The Housing of the Working Classes;" John P. Fox, of New York, an authority on traffic problems, and Charles Browner on "The City Beautiful;" B. Antrim Haldeman, of Philadelphia, on "The Fundamental Principles of Town Planning;" James Ford, of Harvard University, on "The Social Aspects of Town Planning," and C. Whitehall, of Milwaukee, dealt with the financial side of town planning.

The following officers were elected by the Rochester Engineering Society at their annual meeting: President, D. P. Falconer; first vice president, G. S. Dey; second vice president, Ivor Lungard; secretary-treasurer, E. F. Davidson (re-elected).

The thirty-fifth convention of the National Electric Light Association was held at Seattle, Wash., from June 10 to 13, and while it was not equal to the convention of 1911, held in New York City, in point of attendance, it was one of the most important in regard to papers, reports and discussions in the interest of central station policy, operation and maintenance ever held in the history of the association. The following officers were elected for the coming year: President, F. M. Tait, Dayton, O.; first vice president, J. B. McCall, Philadelphia; second vice president, H. H. Scott, New York; treasurer, W. W. Freeman, Brooklyn, N. Y.

The nineteenth annual convention of the International Association of Chiefs of Police was held in Toronto, Ont., Can., on July 9-13, with a registration of about 300. A number of addresses on the cause, handling and prevention of crime were given. Officers were elected as follows: President, Major Sylvester, Washington; first vice president, Michael Regan, Buffalo; second vice president, Col. Percy Sherwood, Ottawa; secretary-treasurer, Harvey O. Carr, Grand Rapids, Mich. The convention of 1913 will be held in Washington, D. C.

The following officers were elected by the Playgrounds and Recreation Association of America at their sixth annual convention, held in Cleveland, O., recently: Joseph Lee, Boston, Mass., president; Harold F. McCormick, Chicago, first vice president; William Kent, California, second vice president; Robert Garrett, Baltimore, Md., third vice president; Gustave T. Kirby, New York, treasurer.

Among the topics for discussion at the convention of the International Association of Fire Engineers, to be held in Denver, Col., on September 18-20, are the following: "Fire Prevention and Building Inspection by Members of Fire Departments," Fred Brodbeck, chief, Salina, Kans., A. M. Schoen, manager Southeastern Underwriters' Association, Atlanta, Ga.; "The Triple Combination Hose Wagon, Chemical and Pumping Engine," F. J. Connery, chief, Newcastle, Pa.; "The Proper Location of Sprinkler Tanks—Should They Be Located on Roofs, Fire Walls or Separate Towers?" J. A. Tremblay, chief, Montreal, Canada; "Tractors for Steam Fire Engines, Aerial Trucks and Water Towers," John Kenlon, chief, New York, R. H. Bowker, chief, Passaic, N. J.; "The Care of Fire Hydrants to Prevent Freezing and the Best Way to Thaw Out Frozen Fire Hydrants," C. W. Ringer, chief, Minneapolis, Minn., John Aiken, chief, London, Ont.; "Direct Connection from City Water Mains to Sprinkler Systems and Standpipes," F. A. Raymond, engineer, National Board of Fire Underwriters, New York; "Motor vs. Horse-drawn Apparatus in Heavy Snows," James Smart, chief, Calgary, Canada; "The Efficiency of the Motor Pumping Engine," Geo. W. Booth, chief engineer, National Board of Fire Underwriters, New York.

The program for the eighteenth annual convention of the Ohio Electric Light Association, held at Cedar Point, O., July 16-19, in-

cluded the following papers: "Rate Making," Halford Erickson; "The Public vs. the Utility," D. L. Gaskill; "Electrolytic Purification of Sewage," F. C. Caldwell; "Supply of Electric Current to Rural Districts," J. C. Mathieu; "Joint Pole Line Construction," J. L. Spore.

Calendar of Technical Meetings.

Virginia State Firemen's Association—Twenty-sixth annual convention and tournament, Roanoke, Va., August 28-30. L. E. Lookabill, vice president, Roanoke, Va.

International Association of Municipal Electricians—Seventeenth annual convention, Peoria, Ill., August 26-30. Clarence R. George, secretary, Houston, Tex.

International Congress for Testing Materials—Sixth congress at New York City, September 2-7. Secretary of organizing committee, H. F. J. Porter, 29 West Thirty-ninth street, New York.

International Congress of Applied Chemistry—September 4, at Washington; September 6-13, at New York City. Bernhard C. Hesse, secretary, 25 Broad street, New York.

International Association of Fire Engineers—Annual convention, Denver, Col., September 17-20. James McFall, secretary, Roanoke, Va.

New England Water Works Association—Thirty-first annual convention, Washington, D. C., September 18-19. Willard Kent, secretary. Headquarters, Boston, Mass.

Central States Water Works Association—Sixteenth annual convention, Detroit, Mich., September 24-26. R. P. Bricker, secretary, Shelby, O.

New York Fire Exposition and International Conference of Fire Prevention, Protection and Extinguishment—Seventy-first Regiment Armory, New York City, October 2-12. A. D. V. Storey, secretary, 1269 Broadway, New York, N. Y.

American Society of Municipal Improvements—Annual convention, Dallas, Tex., November 12-15. A. Prescott Folwell, secretary, 50 Union Square, New York City.

Personal Notes.

J. Fred Thomas has been appointed boro engineer for the boro of Farrell, Pa.

C. O. Vandevanter has been appointed assistant city engineer of Baltimore, Md.

Bruno L. Durst has been appointed city engineer of Port Arthur, Tex., succeeding C. E. Dunwoodie.

William L. Vennard has been appointed city engineer of Lynn, Mass., succeeding the late George I. Leland.

W. M. Davis has resigned as city engineer of Prince Rupert, B. C., in which capacity he has served for a number of years.

F. N. Holmquist has been appointed city engineer of Phœnix, Ariz. He has been connected with that department in the city for some time.

Charles F. Uebelacker, Charles N. Black and William von Phul have been admitted to partnership in the engineering firm of Ford, Bacon and Davis, 115 Broadway, N. Y.

John A. Pettigrew, who was formerly superintendent of parks in Boston, Mass., and also at various periods in Brooklyn, N. Y., Milwaukee, Wis., and Chicago, Ill., died July 2 in Boston.

William J. Zartmann, formerly superintendent of parks, boro of Brooklyn, New York city, has been appointed principal assistant engineer of the department of parks of the boro of Queens, in charge of construction.

Dabney H. Maury, consulting engineer, will on August 1 remove his offices from Peoria, Ill., to 1137-38 Monadnock Building, Chicago, Ill., where he will carry on a practice in water works supply and purification, sewerage and sewage purification, lighting and power plants, and the appraisal and adjustment of rates of public utilities. Douglas A. Graham will be Mr. Maury's principal assistant.

Sir Maurice Fitzmaurice has resigned as chief engineer to the County Council of London, England, to take effect in December. He will engage in private practice after that time. He became chief engineer to the London County Council in 1901. Prominent among the works carried out under his direction in this capacity have been the reconstruction of street railways, the new Vauxhall bridge, the Rotherhithe tunnel, subways and the duplication of the main drainage system of the city.

The McGraw Electrical Directory.

The semi-annual edition of the McGraw Electrical Directory, published by the McGraw Publishing Company, of New York, has been received. It contains a complete classified list of manufacturers of central station and general electrical supplies and equipment; a list of all central stations in the United States, together with information regarding each, the officers, capitalization, etc.; an index to lighting companies; a summary of central stations by states, and a complete list of electrical supply dealers and contractors.

The Youngest Mayor.

Joe F. Sullivan, who was recently elected mayor of Imboden, Arkansas, is the youngest mayor of an American city. Mr. Sullivan, who is also the editor of the Imboden Gazette and a writer of short stories won his office by a series of articles on the county political situations which attracted attention to his ability. He is 21 years of age.

MACHINERY AND TRADE

The "Peerless" Pick-Up Hand Sweeper.

The Baker Manufacturing Company, 705 Fisher Building, Chicago, Ill., have taken over the western selling rights for the "Peerless" pick-up hand sweeper.

The machine mentioned has been in use for a number of years in factories, foundries, flour mills, etc., and has recently demonstrated it value in street sweeping. It is said that it cleans sheet asphalt, asphalt block, brick, wood block, bitulithic, bituminous macadam or any other kind of smooth pavement satisfactorily. The universal testimony of those who have used the machine declares it to be sanitary, efficient and economical.

It is very simple in construction and easy to operate, being light and easily pushed along over the pavement, sweeping a path about thirty inches wide. It picks up and deposits in a receptacle which is a part of the machine all the dirt and sweepings in the path of operation. The receptacle will hold, under ordinary conditions, the sweepings from an area of between 750 and 1,000 square yards, which can be dumped wherever the operator pleases by merely pulling a handle which is attached to it.

The sweeping part of the machine consists of a circular brush or broom thirty inches long and thirteen and a half inches in diameter. This revolves within a metal inclosure on the same principle as the revolving brush in a carpet sweeper. This brush is geared to the main axle with a ratio of four to one, so that the brush revolves four times to each revolution of the main axle. By the operation of a simple attachment, the wear of the broom is compensated for at all times, so that without any trouble to the operator it perfectly adjusts itself at the proper angle for sweeping.

When the bag system is used in conjunction with the machine, a tremendous saving is effected, as the bags cost about five or six cents each, while cans to do the same work cost from $2.50 to $3.50 each. The machines are equipped with hooks on the cross rods of the handle, and the men, when provided with bags in the morning, can attach a bag to the handle, in which papers and other materials which the machines do not pick up can be placed.

The material collected in this way is not bulky or heavy, and when the sweepings of a block have been deposited in one pile the operator then uses a short handle shovel to shovel these sweepings into the bag, the mouth of which is held open with the hooks. The same is then unhooked, tied up with a string, and set upon the sidewalk for the pick-up wagon. In this way all of the sweepings which have once accumulated are absolutely taken from the street surface, while where the can system is used, if the sweepings are dry, all of the fine dust and dirt is blown out of the tops of the cans, and in many instances the entire can is knocked over and scattered about the streets. The city of Hartford sells the sweepings accumulated in this way for $1 per cord, so that the bags cost them practically nothing.

With the old method of a push broom 16 inches wide four men sweep a space 44 inches wide in a slow, halting manner. With the Peerless Sweeper two men and two machines clean 60 inches as fast as the men walk, therefore a saving is effected and the dust nuisance is overcome.

The Hotchkiss Steel Forms.

A contractor in New York during the last year laid over a million square feet of sidewalk at a saving of $15,000, and did it because he used steel sidewalk forms and used them intelligently. Every contractor recognizes the waste and expense incident to the old stake and two-by-four method of laying sidewalks.

The Hotchkiss Lock Metal Form Company, Binghamton, N. Y., are manufacturing metal forms for both sidewalk and curb and gutter work, which involve the best modern practice in this work.

The Hotchkiss steel sidewalk form is a jointed section system designed on the most simple principles so as to be easily handled by unskilled labor. The forms consist of straight, rigid side-rails, flexible side-rails, cross-pieces or division-plates of various lengths, and wedge-shaped keys or lugs for fastening these parts together. The rigid side-rails are 10 feet long, 4 inches high, and have slots at one-foot intervals to receive the division-plates. They have a flange at top

and bottom to keep them rigid, and in use are joined end to end by a tongue and socket. Rigid side-rails are also made 4 feet and 6 feet in length, slotted at 3-inch and 6-inch intervals.

The flexible side-rails are made 4, 6, 8 and 10 feet long, 4 inches high, and have no flanges. They are made of spring steel and may be bent to any desired curve; for curves of long radius flexibles are made of heavier steel. The cross-pieces or division-plates are simple; all that is required of them is uniformity.

The Hotchkiss steel curb and gutter forms consist of steel templates which conform in shape to the finished curb and gutter. To serve as molds for the back of the curb and front of the gutter are provided steel channels, which are slotted at regular intervals. On the front and back of the templates are tongues which pass through these slots and are locked there by lugs on the outside. When set up in this manner they make a rigid and substantial form that will stand alone and which does not need any stakes or braces.

There is one size and style of curb and gutter so generally specified in cities thruout the country that it has been adopted as a standard. This provides for a curb 12 inches high at the back, 6 inches thick, and having a face of 6½ inches high. The gutter is 18 inches wide and dips toward the curb 1½ inches. The outer edge of the curb and junction of the curb and gutter are rounded on a 1½-inch radius. The back of the curb is made with a batter of 1-inch on 12 inches, both because it is good construction and because it assists in the immediate removal of the forms without waiting for the cement to set.

Probably no invention of recent years has done more to revolutionize any industry than has the system of steel forms. They are now used by hundreds of the leading contractors thruout the country, who are highly pleased with them and find that these forms save them over one cent per square foot on all of their sidewalk work alone, and enable them to lay 25 per cent. more walk per day with the same gang.

A Power Machine for Spraying Trees.

The illustration herewith shows a new power spraying outfit of extra large capacity made for spraying shade trees in city parks and for large commercial orchard service. The outfit is known as the Elm Tree Special and consists of a Triplex Power Pump, made by the Goulds Manufacturing Company, of Seneca Falls, N. Y., driven by a gasoline engine. The engine and pump are mounted together on truck with the tank and tower.

The pressure obtained with this outfit is sufficient to permit thoro work to be done on the tallest trees, and its large capacity makes it possible to spray large numbers of trees in a comparatively short time.

A POWER SPRAYING MACHINE.

Trade Publications.

The Standard Scale and Supply Company, 1345 Wabash avenue, Chicago, Ill., have a very interesting catalog of "The Standard" line of low charging concrete mixers. The mixers are shown in operation on various classes of work, and special designs are noted for particular conditions.

The Universal Portland Cement Company is issuing each month a periodical devoted to the use of concrete on road construction. The publication is broad in its nature, and includes besides the specialized matter for which it is issued a great deal of a general interest relative to good roads.

The Vulcanite Portland Cement Company, Land Title Building, Philadelphia, Pa., have published a typical curve of tensile strain of their cement.

The Nelson Valve Company, Chestnut Hill, Philadelphia, Pa., have for distribution their catalog "S," showing steel valves made of acid open hearth steel. The catalog is arranged so that the architect can clearly specify without the usual great amount of trouble, and the engineer will find an asssortment of steel valves that will be quite a "find," for the variety offers gate valves, globe valves, angle valves, vertical valves, cushioned non-return stop valves, cushioned non-return valves, check valves, throttle valves and blow-off valves. Valves are shown for superheated steam, as well as for high-pressure saturated steam and for severe hydraulic work.

The Lead Lined Iron Pipe Company, Wakefield, Mass., have a catalog of their pipe and fittings and of lead-covered coils, tubes and pipe. The lead-lined pipe is formed by a lead lining amalgamated to an iron casing, the two metals being so joined that they cannot be torn apart by bending or rough usage.

The Standard Manufacturing Company, 185 Union street, Worcester, Mass., have a booklet called "The Construction and Maintenance of Roads with Bitumen by the Layer Method." It contains a full description of the methods employed on such construction, together with specifications for gravel, asphaltic oil and refined tars.

The Hersey Manufacturing Company, E street, South Boston, Mass., has a forty-page booklet composed of letters laudatory to the Hersey Detector Meter. The meter mentioned is endorsed in these letters by water departments and underwriters alike.

"The Cleaning of Water Mains" is the title and subject of a publication by the National Water Main Cleaning Company, 61 Park Row, New York city. Numerous photographs are given to illustrate the methods and effects attained in connection with their system of cleaning water mains.

Trade Notes.

Florence, Ariz.—The contract for furnishing a concrete mixer at the penitentiary has been awarded to the Ransome Concrete Machinery Co., of Dunellin, N. J.

Chicago, Ill.—The Keystone Driller Co. announce the establishment of a southern brauch office at 1639 Candler Bldg., Atlanta, Ga. The office is in charge of Mr. McCarthy, who will look after the sale of the Keystone well-drilling machinery and Down-Deep well pumps in the Southern States.

Chicago, Ill.—The Creosoted Wood Paving Block Association has moved its offices to the Otis Building, 10 South LaSalle st., Chicayo, Ill.

New Orleans, La.—Bids will be received Aug. 16, at 12 m., for furnishing one traveling crane of forty tons capacity, electrically operated, and one of ten tons capacity hand operated. Geo. G. Earl, gen. man.; F. S. Shields, secretary.

New York, N. Y.—The MacArthur Concrete Pile and Foundation Co., of 11 Pine st., New York, announce that they have been awarded the contract for placing the pile foundations for a large factory building of John B. Lewis & Bros. Co., of Philadelphia.

Patents Concerning Road Construction and Repair.

979,047. Road Grader and Drag. Thos. I. Swagerty and Arthur L. Lowe, Fontana, Kan.

979,338. Road Scraper. Geo. D. Rhodes, Groton, N. Y.

979,577. Process of and Templet for Use in Laying Pavements. Eugene Geo. Schwendeman, Oak Park, Ill.

979,754. Gutter Bridge. Calvin C. Fouts, Middletown, O.

980,002. Oil Distributing Apparatus. Chas. P. Price, Malden, Mass. (For Roads.)

980,394. Apparatus for Maintaining Crowned Roads. Wm. C. Anderson, San Jose, Cal.

980,513. Means for Laying Dust and the Like on and Making Roads. Robert Hacking, W. Bridgford, Harry Hill, Ollerton, and Henry Walker Hill, Nottingham, England.

980,612. Road Grading Machine. Wm. H. Dawkins and Francis G. Dorough, Royston, Ga.

981,225. Bituminous Paving Cement. Clifford Richardson, New York, N. Y.

981,685. Process of Making Roadways, Railroad Beds, Pavements and the Like. Michael A. Popkess, Kansas City, Mo.

981,710. Road Grader. John T. Starr, Nowata, Okla.

982,247. Concrete Roadway. Edward M. Chadbourne, San Francisco, Cal.

982,309. Road Scraper and Grader. Geo. K. Smith and Ralph Russell, Albany, John Anderson, Jr., and Howard Grimes, Newcomb, N. Y.

982,427. Road Grader. David P. Henninger, Redondo Beach, Cal.

982,944. Road Grader. John B. Fender, Kaufman, Tex.

984,543. Compound for Forming Paving. David Crockett, Birmingham, Ala.

984,634. Combined Scraper and Drag. Hiram S. Wood, Oskaloosa, Iowa.

984,801. Method of Making Pavements. Cloyd Davis, Mineola, N. Y.

985,214. Paving Tool. Aaron W. Shroyer, Durham, N. C.

986,113. Road Scarifier. Edward Wright, Brooklyn, N. Y.

986,290. Road Roller. Pliny E. Holt, Stockton, Cal.

986,421. Road Grader. Andrew K. Skow, Newton, Iowa.

987,060. Paving Block. Frank Galgano, New Rochelle, N. Y.

987,726. Process for Making Roads, Pavements, etc. Jules Lassailly, Issy-les-Molineaux, France.

987,803. Road Drag. Edward J. Hickok, Chicago, Ill.

988,818. Garden and Road Roller. Arthur S. F. Robinson, Beceles, England.

990,488. Road Grader. John S. Lord, Ogden, Iowa.

990,846, 990,847. Road Roller. Henry F. Crandall, Racine, Wis.

991,043. Process of Making Roadways. Joseph E. Ward, Long Beach, Cal.

991,172. Culvert. George A. Sagendorph, Newton, Mass.

992,573, 992,574. Armored Paving. Peter P. McMenamin, Jersey City, N. J.

992,649. Concrete Spreader for Ditches, Sidewalks and Other Surfaces. George W. Gale, Greeley, Col.

993,244. Metallic Curb and Gutter. George W. Harrisbrough, San Francisco, Cal.

993,487. Road Scraper. Jacob Williamson, Ava, Ill.

993,618. Apparatus for Treating Roads. Henry K. Porter, Boston, Mass.

994,092. Concrete Roadway. Edward M. Chadbourne, San Francisco, Cal.

995,147. Composite Pavement. Harry G. Jennison, Toledo, O.

995,180. Culvert. Marshall A. Quinn and Lyman C. Stewart, Roanoke, Va.

IMPROVEMENT AND CONTRACTING NEWS

ROADS AND PAVEMENTS.

BIDS REQUESTED.

Marion, Ala.—Aug. 12, 12 m. Constructing 4 miles of state aid road, amount to be expended $8,000. Also constructing 5 additional miles of gravel road. Certified check, $400. W. S. Keller, state highway engineer.

Marion, Ala.—Aug. 12, 2 p. m. Clearing, grubbing, grading, draining and surfacing with gravel about 4½ miles of Uniontown-Marion road. Certified check, $1,000. Geo. C. Scales, county highway engineer.

Montgomery, Ala.—Aug. 6, 12 m. Grading draining and macadamizing part of Crow Creek road at Bass, near Stevenson. Expenditure, $4,000. Also constructing road to Tennessee state line. Expenditure, $14,000. Certified check, $400. W. S. Keller, state highway engineer.

Bedford, Ind.—Aug. 6, 1 p. m. Constructing the old Meridian gravel road in Marion township and Woods Ferry road in Indian Creek township. E. W. Edwards, auditor.

Bloomington, Ind.—Aug. 6, 2 p. m. Constructing a stone road in Bloomington township. Horace Blakely, auditor.

Bluffton, Ind.—Aug. 6, 1 p. m. Constructing three gravel and stone roads. L. A. Williamson, auditor.

Brazil, Ind.—Aug. 6, 11:30 a. m. Constructing a macadamized road known as J. P. Acree road. E. A. Skaggs, auditor.

Brookville, Ind.—Aug. 5, 12 a. m. Constructing a road in White River township. Charles G. Reifel, auditor.

Brownstown, Ind.—Aug. 5, 1:30 p. m. Constructing a gravel road known as the Shields road, between Jackson and Redding townships. Constructing a gravel road in Carr township. H. W. Wacker, auditor.

Connersville, Ind.—Aug. 5, 10 a. m. Constructing a macadam road in Orange township, known as Lewis Mathey, et al., free stone road. Constructing a macadam road in Connersville township. Jaspeh I. Kennedy, auditor.

Corydon, Ind.—Aug. 6. Constructing four gravel roads. Wm. Taylor, auditor.

Crawfordsville, Ind.—Aug. 6, 10 a. m. Grading, draining and paving the following roads: S. C. Kennedy road, the Jesse Ward road, the James A. Quick road, the J. B. Cowan road. Bond double the amount of each bid.

Crown Point, Ind.—Aug. 5, 8 p. m. Constructing 11,900 sq. yds. of pavement on N. Main street. H. V. Parry, city clerk.

Crown Point, Ind.—Aug. 6, 12 m. Constructing several gravel roads. Chas. A. Johnson, auditor.

Danville, Ind.—Aug. 5, 10 a. m. Constructing a road known as the John R. Hull, et al., public highway in Brown township. Lewis Borders, auditor.

Decatur, Ind.—Aug. 6, 10 a. m. Constructing a macadamized road in Preble township, known as William Bisck macadam road; also for macadamized road known as Aug. Conrad road in same township. H. S. Michaud, auditor.

Greencastle, Ind.—Aug. 7, 10 a. m. Constructing the John F. Stevenson and D. B. Taylor gravel roads. C. L. Airhart, auditor.

Huntington, Ind.—Aug. 5, 10 a. m. Constructing two roads. Harold Guthrie, auditor.

Jeffersonville, Ind.—Aug. 5, 10 a. m. Constructing 1.28 miles of crushed stone road in Clark county. Commissioners of Clark county. Geo. W. Stoner, auditor.

Kent, Ind.—Aug. 5, 2 p. m. Constructing two macadam roads in Iroquois township. E. R. Bringham, auditor.

Lawrenceburg, Ind.—Aug. 6, 12 m. Constructing roads in Washington and Cæsar townships. William S. Fagaly, auditor.

Logansport, Ind.—Aug. 6, 10 a. m. Constructing six macadam roads. J. E. Wallace, auditor.

Logansport, Ind.—Aug. 7, 12 m. Constructing a gravel road on the county line. J. E. Wallace, auditor of Cass county; M. G. Haun, auditor of Carroll county.

Madison, Ind.—Aug. 6, 2 p. m. Constructing three macadamized roads. A. M. Taff, auditor.

Marion, Ind.—Aug. 6, 2 p. m. Constructing a stone road between Grant and Huntington counties. E. H. Kimball, auditor of Grant county.

Muncie, Ind.—Aug. 12, 10 a. m. Constructing a road in Harrison township. Frances M. Williams, auditor.

Paoli, Ind.—Aug. 6, 2 p. m. Constructing a gravel road. Alvin B. Ham, auditor.

Rensselaer, Ind.—Aug. 5, 2 p. m. Constructing a stone road in Carpenter township. Joseph P. Hammond, auditor.

Shelbyville, Ind.—Aug. 7, 10 a. m. Constructing highway in Union township. Frank W. Fagel, auditor.

Terre Haute, Ind.—Aug. 3, 11 a. m. Constructing a macadam road and bituminous binder covering in Sugar Creek township. Nathan G. Wallace, auditor.

Vincennes, Ind.—Aug. 6, 2 p. m. Constructing 8,575 ft. of gravel roads in Widner township. John T. Scott, auditor of Knox county.

Washington, Ind.—Aug. 6, 2 p. m. Bids will be received by commissioners of Daviess and Greene counties for the construction of pike road between said counties. Lew S. Core, auditor Daviess county.

Williamsport, Ind.—Aug. 5, 1 p. m. Constructing roads in Liberty and Jordan townships. David H. Moffitt, auditor.

Winamac, Ind.—Aug. 6. Improving highway in Pulaski county by draining, grading and graveling. Bond twice the amount of bid. W. E. Munchenburg, auditor of Pulaski county.

Jackson, Miss.—Aug. 6, 12 M. Paving North street and N. Gallatin street with brick, bitulithic, wood block, sheet asphalt, grantoid and Dolarway. Certified check, 5 per

cent. J. N. McLeod, street commissioner.

Jackson, Miss.—Aug. 8, 10 a. m. Constructing gravel roadways along the following streets: Hooker avenue, Terry road, N. State street, W. Capitol street, and Bailey avenue. Certified check, $200. George W. Sarlls, engineer.

Macon, Miss.—Aug. 7, 2 p. m. Constructing 24.5 miles of sand-clay road, including 38,000 yds. earth excavation, certified check, 3 per cent.; constructing 16 mi. of sand-clay road, including 39,000 yds. earth excavation, certified check, 3 per cent. N. Scales, L. F. Holberg, S. M. Thomas, road commissioners of District No. 3.

Cincinnati, O.—Aug. 9, 12 m. Resurfacing the Cleves-Warsaw pike for a distance of 18,000 ft. under Specification No. 369. Bond, $1,000. Stanley Struble, president; Albert Reinhardt, clerk, board of Hamilton county commissioners.

Cincinnati, O.—Aug. 9, 12 m. Improving the Symmestown road under Specification No. 373. Certified check, $1,000. Stanley Struble, president; Albert Reinhardt, clerk, board of Hamilton county commissioners.

Columbus, O.—Aug. 9, 10 a. m. Grading and paving with bituminous concrete Section No. 3, the Winchester road. State highway 'D' pet. No. 213. Length, 2.14 miles; width, 14 ft. Estimated cost, $22,-044.80. Certified check, $300. Commissioners of Franklin county; James R. Marker, Columbus, O., state highway commissioner.

Portsmouth, O.—Aug. 5, 1 p. m. Grading and paving with brick, the Portsmouth-Columbus Ext. road. State highway 'B' pet. No. 492. Length, 1.02 miles; width, 16 ft. Estimated cost, $14,225.35. Certified check, $300. Commissioners of Scioto county; James R. Marker, Columbus, O., state highway commissioner.

Portsmouth, O.—Aug. 7, 12 m. Grading and improving the Henley and Comstock roads for a distance of 7,500 ft. Certified check, $100. Thos. C. Patteson, county auditor and clerk, board of county commissioners.

South Bethlehem, Pa.—Aug. 5. Paving with Amiesite portions of Second street, Northampton avenue, New street, Elm street, Fourth street, and Third street. R. E. Neumeyer, borough engineer.

St. Clairsville, O.—Aug. 6, 11 a. m. Grading and paving Section No. 1, the Belmont road. State highway 'H' pet. No. 191. Length, 1.42 miles; width 13 ft. Estimated cost, $18,378.24. Certified check, $300. Commissioners of Belmont county; James R. Marker, Columbus, O., state highway commissioner.

Duquesne, Pa.—Aug. 3, 12 m. Grading, curbing and paving Wilmot street. Furnishing 30,000 wire-cut paving bricks. R. T. Dell, city engineer. W. E. Reed, city clerk. L. W. Francis, chairman of street committee.

Racine, Wis.—Aug. 10, 10 a. m. Paving Sixth street with brick, including 1,070 sq. yds. of paving and 480 lin. ft. of curb reset. Bond, amount of bid. Paving Fourth street with brick, including 1,120 sq. yds. of paving and 480 lin. ft. of curb reset. Bond, amount of bid. Paving Eighth street, including 323,-322 sq. yds. paving, 480 lin. ft. curb reset, 587 lin. ft. curb, new, 218 lin. ft. curb reset, 1 manhole, 3 catchbasins, 1 catchbasin, rebuilt. Bond, total amount of bid. P. H. Connolly, G. W. Grenier, J. Blessinger, board of public works.

CONTRACTS AWARDED.

Mobile, Ala.—Constructing 10 miles of Cedar Point road, to W. H. Holcombe, $26,-090.63.

Montgomery, Ala.—Paving Earle street with bituminous concrete, to the Southern Paving and Construction Co., $1.77 per sq. yd.

Nevada City, Cal.—Constructing the Burkhalter-Iseland road, to John Duffy, $9,475.

San Jose, Cal.—The following contracts have been awarded: Constructing 10 miles of Madera City-Califa road, to Ransome-Crummey Co., $72,091; constructing 5 4-10 miles of S. San Francisco-Burlingame road, to F. R. Ritchie Co., San Francisco, Cal., $89,368; constructing a 13-mile road from county line of Mendocino county to Hopland, to the General Contracting Corporation, San Francisco, Cal., $67,425; constructing 9 miles of road from Morrison's crossing to Marysville, to F. E. Frey, Sacramento, Cal., $67,-780.

Decatur, Ill.—Paving W. Forest street and McClellan avenue, to Lisle Hunt, $13,686.50; paving W. Main street, to Lisle Hunt, $11,-133.50.

Lewistown, Ill.—Paving several streets, to Mr. Prosser.

Newton, Ill.—Paving a street with cement, to Connor and VonDuesen, $13,073.

Quincy, Ill.—Paving the down-town district with brick, to A. D. Thompson Co., Peoria, Ill., $28,365.57.

Virginia, Ill.—Paving about two miles of streets, to the Illinois Cement Construction Co., Springfield, Ill., $21, 583.

Bloomington, Ind.—Constructing a stone road in Perry county, to McCormick and Rogers, of Smithville, $4,678.

Fort Wayne, Ind.—Paving 9,000 sq. yds. of street, to the Grace Construction Co.; constructing 6,000 sq. ft. of pavement on Pontiac boulevard, to the John Grosjean & Bro. Co., $15,000.

Huntington, Ind.—The following road contracts have been awarded: Geo. S. Fahl road to Beal and Bell, Logansport, Ind., $12,700; John W. Morrow road, to Garrett, Gordon & Brinneman, Bluffton, $9,865.

Jasper, Ind.—Constructing roads in Dubois county, to Me. Eigleman, $9,350.

Kokomo, Ind.—Constructing two gravel roads in Howard county, to O. F. Peterson, $1,717.50.

Lebanon, Ind.—Constructing a gravel road, to John Haffur, of Zionsville, Ind., $5,445.

Madison, Ind.—Constructing roads in Jefferson county, to Jos. Stanley & Co., Madison, Ind., $5,200, and to Jas. E. Miles, Madison, Ind., $412.75.

Newport, Ind.—Constructing state road in Helt township, to Ingram & Co., $7,946.85; constructing the Lewis Runyan road in Clinton township, to Peter Aikman, $7,965; constructing the Clehy road, to Ray G. and Henry C. Jester, $4,180.

Shelbyville, Ind.—Paving four streets, to Breese & Brown, Mattoon, Ill., $55,329.72.

Terre Haute, Ind.—Constructing Ed B. Ferguson gravel road, to Harry B. Carpenter, Cloverland, $8,700.

Tipton, Ind.—The following road contracts have been awarded: The Cor and J. W. Renie gravel roads, to E. L. Hoffman, $1,695 and $745, respectively; the William Pratt gravel road, to W. H. Jarrett, $1, 664.

Valparaiso, Ind.—The following road contracts have been awarded: Westchester township gravel road, to Ray Demass, Chestertown, $13,890; the Morgan township gravel road, to the Crown Point Construction Co., Crown Point, Ind., $4,925.

Washington, Ind.—The following contracts have been awarded: The McCracken road, to L. S. Horrell, Washington, Ind., $9,536; the Ragsdale road, to E. Allen, Washington, Ind., $3,300; the Fornwald and Scholl roads, to Andrew Reister, $8,420.

Bay City, Mich.—Paving several streets, to Rudolph Blome & Sons, Chicago.

Des Moines, Ia.—Paving the Grand avenue bridge floor with creosoted wood blocks, $4.75 per yard.

Des Moines, Ia.—Paving Ingersoll avenue, Tonawanda drive, Polk boulevard, and Forty-third street, to James Horrabin, $1.95 per yard.

Fort Dodge, Ia.—Paving several alleys with brick, to Zitterell & Sullivan, at $1.98 per sq. yd.

Iowa City, Ia.—Constructing 5,000 yards of concrete paving, to William Horribin.

Marshalltown, Ia.—Constructing about 9,000 sq. yds. of concrete paving, to Elzy & Carlson, at $1.08.

Moline, Ill.—Paving Twenty-third avenue with brick, $35,675.60.

Sioux City, Ia.—Paving Fourteenth street and Summit avenue with concrete, to the Flinn Paving Co., at $1.12 per sq. ft.

Atchison, Kas.—The following contracts have been awarded for the improvement of the Catholic Cemetery road: Grading, to Jack Arnold, 35c per yard; removing rock at 75c per yard, and building culverts, to Pete Barnett.

Iola, Kas.—Constructing 1¾ miles of rock road, to Ransom & Cook, Ottawa, Kas.

Louisville, Ky.—Constructing granitoid pavement on Market street, to Frank Sweeny and John Howe, 18½c per ft.

New Iberia, La.—Constructing 6,200 ft. of sand and gravel paving on E. Main street, to the Chatham Construction Co.

New Orleans, La.—Paving Parkerson avenue, to the Creosoting and Wood Paving Co., $75,000.

New Orleans, La.—Paving Frenchman street with asphalt, to the Standard Paving and Construction Co., $35,319.10.

Boston, Mass.—The following paving contracts have been awarded: Improving Ashmont street, to James Doherty, $4,038.2$; for a macadam road in Vaughan avenue, to Jas. Doherty, $2,980.30; improving Buttonwood street, to Hugh J. McGuire, $1,958.78; repaving W. Fourth street, to Hugh J. McGuire, $971.25; improving Kilton street, to Hugh J. McGuire, $970.94.

Bay City, Mich.—The following paving contracts have been awarded: Sherman street and Woodside avenue, to Rudolph S. Blome Co., $13,068.50; street railway right of way on Sherman and Woodside avenues, to the same, $4,343.80; Adams street, to the same, $3,348.62; Third street, to the same, $4,762.88; Sherman street, second section, Carpenter & Anderson, $5,463.50; Water street, to the same, $8,368.40; Adams street, second section, $2,229.60.

Grand Rapids, Mich.—Paving East Fulton street with brick, to Carpenter & Anderson, $59,000; paving Fountain and Eastern avenue, to Harry Vanderveen, $2,798.14 for Fountain street and $7,590.96.

Greenville, Mich.—Constructing brick paving, to J. A. McKay, Clare, Mich.

Ishpeming, Mich.—Constructing two roads, one to John Hogan and the other to William Carmody.

Duluth, Minn.—The following contracts have been awarded: Constructing two miles of road, to John Bergman, $5,112.50; constructing 5½ miles of Byrne road, to John A. Johnson & Sons, $5,175; constructing 2¼ miles of the Aurora road, to W. J. Wallace, $2,365; constructing 1 mile of the Judd road, to W. J. Dundas, $900.

Meridian, Miss.—Constructing 7½ miles of Causeyville road, to the Healy Construction Co., $13,000 to $14,000.

St. Joseph, Mo.—Paving Charles street with Hassam, to the Rackliffe & Gibson Construction Co.

Superior, Neb.—Paving the intersection of Tower avenue and North Third street with macadam, to Diffor & Peterson.

Binghamton, N. Y.—The following contracts have been awarded: Road No. 963, to Lane Construction Corp., $53,208.40; road No. 5423, to W. J. Cowhig, Albany, N. Y., $72,381.50; road No. 5241, to W. E. Bennett, Lanesboro, Pa., $27,403; road No. 5215, to Semper Brothers, Watertown, N. Y., $21,391;

Dunkirk, N. Y.—The following contracts have been awarded: Paving East Front street and Courtney street with concrete curb and gutter, to the Dunkirk Construction Co., $16,990.41 for E. Front street and $16,697.41, to W. Courtney; paving Roberts road with asphalt, to McCormick & Son, $21,366.

Ilion, N. Y.—Paving John, West River and Railroad streets, to the Warren Brothers.

Lockport, N. Y.—Paving Locust street, to Henry P. Burgard, $51,525.56.

New York, N. Y.—The following bitulithic macadam paving contracts have been awarded: Locust street, to the Uvalde Contracting Co., $31,075; Third avenue, Fourth and Whitestone avenues, to the Standard Bitulithic Company, $54,486.50; Cooper avenue, to the Uvalde Co., $49,332.50; Union turnpike, to Standard Co.; Laurel Hill boulevard, to the Standard Co., $51,215; Hillside avenue, to the Uvalde Co., $16,580; Rocky Hill road, to the Uvalde Co., $56,742.50; Rockaway plank road, to the Uvalde Co., $90,515; Bell avenue, Willitss road, Fourteenth street and Eleventh avenue, to the Standard Co., $93,888; Jackson avenue, Warren Quinlan Contracting Co., $57,804.75; Trotting Course lane and Woodlawn avenue and Jamaica road, to the Standard C., $58,420; Mott avenue, Central avenue, Washington avenue, Standard Co., $50,865; Little Neck road and Floral Park road, Standard Co., $59,797.50; Springfield road and Lincoln avenue, to the Uvalde Co., $81,225.

Nunda, N. Y.—Constructing the Portage, Nunda-Mt. Morris road, to the following: Part 1, to G. R. March, Philadelphia, Pa., $50,769.08; part 2, to Thomas F. Murray, Le Roy, N. Y.; part 3, to Harradine Bros., Spencerport, $80,245.10.

Cincinnati, O.—Paving Ravine street with bituminous macadam, and Belldare avenue with brick, to the Kirchner Construction Co.

Cincinnati, O.—Paving Mozart avenue with brick, to the Kirschner Construction Co., $11,710.

Dayton, O.—The following contracts have been awarded: Paving Hawthorne street, to the J. E. Conley Co., $7,875.60; paving Dunbar street, to the same, $6,819.30.

Dayton, O.—Repairing the asphalt streets of the city, to the Andrews Asphalt Co.

Elyria, O.—Constructing pavements on E. River street, Harrison street, Seventh street and East Broad street, to the Elyria Construction Co.

Steubenville, O.—The following paving contracts have been awarded: Washington street, to H. M. Bates, $4,814.75; Wilkins street, to John O. Bates, $9,821.55; Wellesley avenue, to H. M. Bates, $18,684.70; Madison avenue, to H. M. Bates, $1,664.20; alley C, to F. H. Patterson, $656.50.

Eugene, Ore.—Paving six blocks, to the Clark & Henery Construction Co., $20,000.

Portland, Ore.—Paving Twentieth street with bitulithic, to the Pacific Bridge Co., $18,516.

Harrisburg, Pa.—Constructing 10,115 ft. of state road, to J. F. Shanley Co., Philadelphia, Pa., $27,331.37; constructing 10,756 ft. of state road, to Baker-Owen Co., Johnstown, $40,791.08; constructing 4 miles of state road, section one, 14,807 ft., to South Shore Construction Co., $53,109.10; section two, 9,632 ft., to the Northwestern Construction Co., $35,819.09.

Lancaster, Pa.—Constructing 10,334 ft. of asphaltic macadam road, to George C. Souder, $31,280.08.

McKeesport, Pa.—Repaving Fawcett avenue, to Daniel Stratton.

Shenandoah, Pa.—Repaving Main street, to John A. Leffler.

Wilkes-Barre, Pa.—Paving Cunyngham avenue and the extension of Bennett street, to John E. James.

Nashville, Tenn.—Constructing concrete sidewalks on Fourteenth avenue, to the Fisher Concrete Co., 13½c per sq. ft.

Marinette, Wis.—Paving several streets, to Magnuson & Lundin.

CONTEMPLATED WORK.

Talladega, Ala.—A $25,000 bond issue for street improvement has been voted.

St. Petersburg, Fla.—A $65,000 bond issue for street paving and a storm sewer has been voted.

Cordele, Ga.—A $40,000 bond issue for paving construction has been voted.

Aurora, Ill.—The construction of a brick pavement on Broadway and Washington streets is contemplated. Roy White, secy.

Effingham, Ill.—A $35,000 bond issue for road improvement has been voted by Douglass township.

Brazil, Ind.—City Engineer F. Kattman has been authorized to prepare plans for the paving of East Cole street, McDonald street and Washington street with vitrified brick.

Pikeville, Ky.—The city is contemplating the construction of about 25,000. sq. yds. of brick paving within the next 12 months. Plans are now being prepared. Amick and Haynes, city engineers.

Bridgeport, Mich.—A $20,000 bond issue for road improvement has been voted.

Ludington, Mich.—A $50,000 bond issue for street improvement has been voted. G. W. Clark, city engineer.

Minneapolis, Minn.—Winona county will construct 16 mi. of concrete road in the near future.

Galena, Mo.—A $10,000 bond issue for road improvement has been voted.

Springfield, Mo.—A $10,000 bond issue for road improvement has been voted.

Natchez, Miss.—A $150,000 bond issue for road construction has been voted. Clerk board of supervisors, Adams county.

Atlantic City, N. J.—A $35,000 bond issue for paving improvement has been voted.

Hoboken, N. J.—A $25,000 bond issue for repaving has been voted.

Woodbridge, N. J.—A $25,000 bond issue for street improvement has been voted.

Forestville, N. Y.—A $12,000 bond issue for paving has been voted.

Mechanicsville, N. Y.—A $46,241 bond issue for paving construction has been voted.

Minster, O.—A $20,000 bond issue for water works improvement and a $25,000 bond issue for street improvement has been voted.

Toledo, O.—The following bond issues have been voted: $25,660.21 for the improvement of Detroit avenue, No. 7; $1,897.50 for the improvement of Mulberry street, No. 3.

Youngstown, O.—A $1,000 bond issue for improving Gladstone street, and a $2,075 bond issue for improving Saranac avenue, have been voted.

Glenolden, Pa.—A $30,000 bond issue for street improvement has been voted.

Rockwood, Pa.—A $5,000 bond issue for street paving and sewering has been voted.

Yeadon, Pa.—The city council has passed an ordinance providing for a $20,000 bond issue for street improvement.

Athens, Tex.—A 35,000 bond issue for road improvement has been voted.

Taylor, Tex.—A $25,000 bond issue for paving improvement has been voted.

Waxahachie, Tex.—A $25,000 bond issue for paving construction has been voted.

Lawrenceville, Va.—A $75,000 bond issue for road construction has been voted.

Waynesboro, Va.—A $250,000 bond issue for road improvement has been voted.

Crandon, Wisc.—A $5,000 bond issue for road improvement has been voted.

SEWERS.

BIDS REQUESTED.

Mobile, Ala.—Aug. 5, 12 m. Laying 22,000 lin. ft. of storm sewers, ranging from 12-in. tile pipe to 5½x8-ft. concrete culvert, with about 30,000 ft. of 6-in. and 10-in. laterals; also laying 18,900 sq. yds. of creosoted wood block, 16,000 yds. of asphalt, 12,700 yds. vitrified brick on concrete foundation, 220 yds. of gravel and 25,000 lin. ft. of granite curbing. Wright Smith, city engineer.

New Orleans, La.—Aug. 24, 12 m. Constructing a reinforced concrete siphon under the New Basins Navigation canal at Broad street. Certified check, $1,000. F. S. Shields, secretary; Geo. G. Earl, general superintendent.

Columbus, O.—Aug. 14, 12 m. Constructing a sewage disposal plant and appurtenances at the State Serum farm. Bond, 50 per cent. The Ohio State Board of Agriculture. A. P. Sandles, secretary; A. Elliott Kimberly, 8 East Long street, sanitary engineer.

Reading, O.—Aug. 5, 12 m. Constructing sanitary sewers in the village. Certified check, $1,000. Daniel S. Hasbrook, village engineer; Wm. F. Klopmeyer, celrk.

Exeter Borough, Pa.—Aug. 6, 8 p. m. Constructing sewers in Wyoming avenue. Certified check, $300. Wm. F. Dougherty, secretary of borough council; James E. Langan, borough engineer.

New Castle, Pa.—Aug. 12, 8 p. m. Constructing a storm sewer in the Second ward. Certified check, $500. Constructing a storm sewer in the Seventh ward. Certified check, $200. Perry Williams, city clerk.

Aberdeen, S. D.—Aug. 19, 10 a. m. Constructing sewers in First avenue and North Lloyd street, including 732 ft. of 8-in. pipe, 366 ft. of 10-in. pipe and 3 manholes. Certified check, $500. F. W. Raymond, city auditor.

CONTRACTS AWARDED.

Danville, Ill.—Constructing a sanitary sewer, to E. R. Harding, of Racine, Wis.

Decatur, Ill.—Constructing several sewers. to Arthur Birt; one, $449.40, and another, $45.60.

Rockford, Ill.—Constructing sewers in Harlem and Daisy avenues, to Mulholland & Kuehn, $2,431.50.

Elkhart, Ind.—The following sewer contracts have been awarded: Indiana avenue, sewer, to the Elkhart Construction Co.; Fulton street and Arcade avenue, to Frank J. Miller.

Goshen, Ind.—Constructing a trunk sewer, to Charles E. Kutz, $6,450.

Julietta, Ind.—Constructing a sewage disposal plant at the insane asylum, to Dennis Bush, $1,744.

Cedar Falls, Ia.—Constructing 4,350 ft. of sanitary sewer, to the Blackhawk Construction Co., Waterloo, Ia.

Des Moines, Ia.—Constructing the Tiffin and Oxford avenues sewer, to O. P. Herrick, at $1.03 per ft.

Keokuk, Ia.—Constructing four blocks of sanitary sewer, to Frank L. Griffey & Co.

Sioux City, Ia.—Constructing a sanitary sewer in West Sixth street, to D. C. Armstrong, 48 cents per ft.; constructing a sanitary sewer in West Twentieth street, to D. C. Armstrong, 48½ cents per ft.

Hutchinson, Kas.—Constructing several small sewer laterals in various parts of the city, to Polly & Welchon.

Boston, Mass.—The following sewer contracts have been awarded: Constructing a pipe sewer in Plymouth court, to Timothy Coughlin, $588.45; constructing pipe surface drains in Deering and Westmore roads, to R. Cartullo, $1,564.95; constructing pipe sewer and drain in Commonwealth avenue, to George J. Regan, $1,262.50.

Sturgis, Mich.—Constructing several sewers, to F. M. Benner & Co., Marion, Ind., $38,793.50; constructing a sewage disposal plant, to Andrew Geek, Owosso, Mich., $8,647; constructing a pumping station, to F. M. Benner & Co., $945.

Lewiston, Mont.—Constructing a sewer for the east side, to R. M. Barsden & Co., $47,800.

Batavia, N. Y.—Constructing sewer in the Second ward, to Frank, George and Arthur J. Shaw, $44,341.

Dunkirk, N. Y.—Constructing a 10-in. sewer on King street, to Ella Colgan, $393.35.

North Tonawanda, N. Y.—Installing several miles of sewer, to the Frontier Contracting Co., Buffalo, N. Y., $5,442.45.

Monroe, N. C.—Constructing a sewer system, to G. Jaeger, Rich Hill, Mo., $24,000.

Columbus, O.—Constructing the Milo extension sewer, to J. C. Beasley, $30,000 or $35,000.

Erie, Pa.—Constructing a 12-in. sewer in Fifteenth street, to Ed Driscoll.

Franklin, Pa.—Constructing sewers on Atlantic avenue and First street, to Burns Bros., New Castle, Pa.

New Castle, Pa.—The following sewer contracts have been awarded: Sanitary sewer in Sankey street, to W. H. Mayberry, $266.26; sanitary sewer in Stanton avenue, to Charles Staph, $317.90; sanitary sewer in Connor street, to W. H. Mayberry, $186.76; sanitary sewer in Moravia street, to Mr. Staph, $393.86.

Philadelphia, Pa.—The following sewer contracts have been awarded: Twelfth street sewer, to Emilo Pascuzzi, $62,595; constructing sewer in Delaware avenue, to John McMenamy, $29,365; constructing the Rock Run sewer extension in Tenth and Eleventh streets, to the Cantrell Construction Co., $17,495; constructing manholes and inlets, to Vincent Jafalla, $900.

Aberdeen, Wash.—Constructing pavements and sewers, to the Warren Construction Co., $180,890.40.

CONTEMPLATED WORK.

Athens, Ala.—A $38,000 bond issue for sewer extension has been voted.

Bakersfield, Cal.—A $21,000 bond issue for sewer improvement has been voted.

Los Gatos, Cal.—Frank A. Nikirk, town engineer, has prepared plans for improving the sewerage system at an estimated cost of $11,890.

San Diego, Cal.—Councilman A. E. Dodson has authorized to extend $7,000 for new sewers.

Taft, Cal.—A $25,000 bond issue for sewer improvement has been voted.

St. Petersburg, Fla.—A $65,000 bond issue for street paving and a storm sewer and a $20,000 bond issue for sewer extensions and and improvement have been voted.

Cordele, Ga.—A $5,000 bond issue for sewer extensions has been voted.

White Hall, Ill.—An ordinance providing $30,000 for a sewer system has been adopted.

Hobart, Ind.—The city is preparing plans for a $60,000 sewer system.

Lebanon, Ind.—Plans for a sanitary sewer system have been adopted by the city council.

Howell, Mich.—A $48,000 bond issue for sewer construction has been voted.

Marshall, Mich.—The construction of a system of storm sewers, at an estimated cost of $25,000, is contemplated.

Binghamton, N. Y.—A $25,000 bond issue for sewer improvement has been voted.

Mamaroneck, N. Y.—Hering & Gregory, consulting engineers, 170 Broadway, New York City, are preparing plans and specifications for a sewage disposal works. J. M. Duffy, village engineer.

Cleveland, O.—Plans and specifications are being prepared for sewage disposal plants.

Youngstown, O.—The construction of a sewer in Loveless avenue is contemplated.

Pond City, Okla.—Plans and specifications for a sanitary sewer system have been prepared by Benham Engineering Co., 812-14 American National Bank building, Oklahoma City, Okla., at an estimated cost of $20,000.

Darby, Pa.—A $40,000 bond issue for sewer construction has been voted.

New Kingston, Pa.—A $40,000 bond issue for a sewage disposal plant and a $75,000 bond issue for sewer and street improvement have been voted.

Somerset, Pa.—A $5,000 bond issue for street paving and sewers has been voted.

Highmore, S. D.—A $16,000 bond issue for sewer improvement has been voted.

Dallas, Tex.—A $10,000 bond issue for sanitary sewer improvements has been voted.

Paris, Tex.—A $140,000 bond issue for sewer and fire departments has been voted.

Sweetwater, Tex.—A $35,000 bond issue for sewer improvement has been voted.

Princess Anne, Va.—A $10,000 bond issue for water and sewer extensions has been voted.

WATER WORKS.

CONTRACTS AWARDED.

Belleville, Ill.—Laying 1,000 ft. 4-in. water pipe and installing three hydrants, to H. H. Hall Construction Co., East St. Louis, Mo.

Columbus, Ind.—Constructing a mechanical filter, to the Roberts Filter Co., Philadelphia, Pa.

North Attleboro, Mass. — Furnishing a pumping engine to the Epping-Carpenter Co., $7,410.

Fulton, Mo.—Constructing a new water works system, to Thomas Peters, St. Louis, Mo., $25,000.

New Kensington, Pa.—Constructing a filter plant, to Henry S. White, New Kensington, Pa.

CONTEMPLATED WORK.

Haleyville, Ala.—A $20,000 bond issue for water works improvement has been voted.

Pasadena, Cal.—A $1,250,000 bond issue for water works improveemnt has been voted.

Oak Creek, Colo.—A $30,000 bond issue for water works construction has been voted. Allen Cliff, town clerk.

St. Petersburg, Fla.—A $200,000 bond issue for water works improvement has been voted.

Cordele, Ga.—A $40,000 bond issue for water works construction has been voted.

Clarks Fork, Ida.—The construction of a water works system is contemplated.

Logansport, Ind.—Plans and specifications have been prepared for a filtration plant by B. T. Clifford, engineer.

Paoli, Ind.—Constructing extensions to the water works system, to William Hoffman, French Lick, Ind.

Gilman, Ia.—A $12,000 bond issue for municipal water works system has been voted.

Lehigh, Ia.—A $20,000 bond issue has been voted for the erection of a water works and electric light plant.

Clearwater, Kas.—A $23,000 bond issue for water works and light has been voted.

Horton, Kas.—A $38,000 bond issue has been voted for improving the city water works.

Topeka, Kas.—The city will purchase, this fall, a $20,000 pump and will build a pumping station for the city water works plant.

Royal Oak, Mich.—A $33,000 bond issue for a water works system has been voted.

Gibbon, Minn.—A $3,000 bond issue for water works improvement has been voted.

Madison, Minn.—A $50,000 bond issue for water works and electric light improvement has been voted.

Homer, Neb.—A $10,000 bond issue for water works improvement has been voted.

Winnebago, Neb.—A $9,000 bond issue for a water works system has been voted.

Baltimore, Md.—The construction of a filtration plant at a cost of $1,633,000 is contemplated.

Seneca Falls, N. Y.—The Seneca Falls Waterworks Company intends to install a filtration system at their source of supply, at the north end of Cayuga lake. Cost, $30,000.

Lakewood, O.—Mayor J. B. Coffinberry has asked the city council to propose $150,000 of bonds for a filtration plant and a municipal water works system.

Minster, O.—A $20,000 bond issue for water works extension has been voted. A $25,000 bond issue for street improvement was also voted.

Steubenville, O.—The city council has secured an option on a site for a water filtration plant. D. J. Sinclair, chairman of water commission.

Zanesville, O.—Hering and Gregory, consulting engineers, 170 Broadway, New York City, are preparing plans and specifications for a new and improved water supply system.

Cheyenne, Okla.—A $60,000 bond issue for water works construction has been voted.

Hastings, Okla.—A $15,000 bond issue for the completion of the water works system has been voted.

Camden, S. C.—A $10,000 bond issue for water and light improvement has been voted.

Dallas, Tex.—A $1,025,000 bond issue for water works improveemnt has been voted.

Winnesboro, Tex.—A $23,000 bond issue for water works improvement has been voted.

Bridgewater, Va.—A $25,000 bond issue for water works improvement has been voted.

Dublin, Va.—A $10,000 bond issue for water works improvement has been voted.

Princess Anne, Va.—A $10,000 bond issue for water works improvement has been voted.

Oakville, Wash.—A $6,000 bond issue for water works improvement has been voted.

BRIDGES.

BIDS REQUESTED.

Seale, Ala.—Aug. 12, 12 m. Constructing a 90-ft. concrete arch bridge over Little Uchee creek. Certified check, $400. W. S. Keller, state highway engineer.

Brownstown, Ind.—Aug. 5, 1 p. m. Constructing repairs to the Cavanaugh bridge across the Muscatatuck river. Commissioners of Jackson county.

Crown Point, Ind.—Aug. 6, 12 m. Bridge construction as follows: Two bridges in Ross township and one in Cedar township. Chas. A. Johnson, auditor.

Huntington, Ind.—Aug. 7, 10 a. m. Constructing three bridges as follows: One reinforced concrete bridge over Little river at Huntington, the Clark street bridge over the Wabash river, and the Funderburg bridge. H. Guthrie, auditor.

Rensselaer, Ind.—Aug. 5, 2 p. m. Bridge construction as follows: One bridge in Union township; one bridge in Walker township; three bridges in Barkley township and one bridge in Kankakee township. Jos. P. Hammond, auditor.

Marion, Kas.—Aug. 8. Constructing a 40-ft. span reinforced concrete bridge and a 32-ft. span reinforced concrete bridge. R. E. Reimer, county clerk.

Duluth, Minn.—Aug. 5, 10 a. m. Constructing a concrete culvert across the State Line creek. Certified check, 10 per cent. Aug. R. Norman, county auditor.

Cincinnati, O.—Aug. 9. Constructing bridges and culverts on the Batavia road. Albert Reinhardt, clerk, board of Hamilton county commissioners.

Cincinnati, O.—Aug. 16. Constructing a concrete bridge on Neeb road. Albert Reinhardt, clerk, board of Hamilton county commissioners.

Columbus, O.—Aug. 9, 12 m. Constructing a reinforced concrete arch bridge over Black Lick creek on East Broad street. Certified check, $500. F. M. Sayre, county auditor.

Lebanon, O.—Aug. 6, 11 a. m. Constructing a high truss steel bridge with creosoted block floor and concrete abutments over Clear creek. Certified check, $500. T. C. Patterson, county auditor.

Wauseon, O.—Aug. 7, 10 a. m. Bridge construction as follows: Sub and superstructure, 130 ft. in length, 14-ft. roadway on bridge No. 214. Commissioners of Fulton county.

Indiana, Pa.—Aug. 7. Constructing a double reinforced concrete bridge over Two Lick creek. J. Bennett, A. M. Ansley, J. M. Wakefield, commissioners of Indiana county.

Washington, Pa.—Aug. 7, 12 m. Constructing a steel pony truss bridge of 35-ft. span, known as Ely bridge over Wheeling creek. Certified check, $300. John H. Moffitt, county controller; Chaney and Armstrong, engineers.

CONTRACTS AWARDED.

Fosterburg, Ill.—Rebuilding the Bartlow bridge, to Miller and Borcherding, St. Louis, Mo.

Hillsboro, Ill.—Constructing the concrete bridge on Wood street, to Driscoll McCallman, Decatur, Ill.

Millbrook, Ill.—Constructing two new bridges between Five Corners and Newark, to E. B. Sleezer.

Quincy, Ill.—The following bridge contracts have been awarded: A steel bridge on North 12th street, to the Michelmann Steel Construction Co., $1,170; a bridge over Pigeon creek, in Section 36, to the Illinois Steel Bridge Company; a small bridge in Section 4, to Emmet Johnson.

Muncie, Ind. — Constructing several bridges across Kilbuck creek, to the Indiana Bridge Company; constructing the Jordon concrete bridge, to S. B. Royse, $648.

Terre Haute, Ind.—Constructing the federal bridge in Riley township, to Osceola Lowe, $537.

Milltown, Ind.—Constructing a steel bridge, to the Vincennes Bridge Co., Vincennes, Ind., $2,998.

Clinton, Ia.—Constructing 16 bridges in three groups, A. B and C: Group A and C, to the Clinton Bridge and Iron Works, Group A, $4,816.85; Group C, $5,064.90; Group B, to J. R. Kane, $10,015.85.

Leavenworth, Kas.—The following bridge contracts have been awarded: Two concrete steel bridges, to G. F. Dillon; the Dick Miller bridge, to John Pierce, $945; repairing the Doege bridge, to the same, $134; Ward road bridge, to the same, $790; the Opliger bridge, $884, and the Bush creek bridge, $590, to Goldberg and Son; the Ryan bridge, to Missouri Valley Bridge and Iron Works, $627; repairing the Little Stranger bridge, to the Leavenworth Bridge Company, $285; the Salt Creek bridge, to J. F. Mottin; repairing the Plum creek bridge, to the same, $118; repairing the Zimmerman bridge, to the same, $193.

Topeka, Kan.—Constructing a bridge over Kaw river, to the Leavenworth Bridge Co., $29,500.

Saginaw, Mich.—Constructing the substructure of the Johnson street bridge, to W. N. Sager, $28,477.77, and the superstructure to the Detroit Bridge and Steel Co., $44,200.

Kansas City, Mo.—Constructing concrete work on the Broadway viaduct, to the Concrete Foundation Company, $50,000.

Palmyra, Mo.—Constructing 17 iron bridges, to the Dildine Bridge and Construction Company, Hannibal, Mo.

Salamanca, N. Y.—Constructing the Main

street bridge, to the Owego Bridge Company.

New York, N. Y.—Constructing an underground passage to the Brooklyn bridge, to the North Eastern Construction Co., $408,883.

Hicksville, O.—Constructing a bridge over the St. Joe river at Nashville, to George Japp, Ft. Wayne.

Allentown, Pa.—Constructing the 8th street bridge, to the McArthur Bros., New York City, $512,000.

Hazelton, Pa.—Constructing a concrete bridge, to the McArthur Bros., New York City, $500,000.

Lockhaven, Pa.—Constructing substructure of the McElhattan river bridge, to Robert Myers.

Norristown, Pa.—Constructing steel superstructure over Tacony creek, to G. W. Ensign, Camp Hill.

Phoenixville, Pa.—Constructing an arch bridge over Bridge street, to Enos L. Seeds, Philadelphia, Pa.

Reading, Pa.—Repairing the Conners' Crossing bridge, to R. A. Simmons, Pottsville, Pa. Erecting a bridge over Manatawny creek, to Bland and Company, Philadelphia, Pa.

Washington, Pa.—Rebuilding bridge over the Monongahela river, to the Capital Construction Co., Columbus, O., $31,091.50.

Columbus, S. C.—Constructing a bridge over Hampton creek, to M. Goode Homes, $2,131.

Rock Hill, S. C.—Constructing a bridge over King's creek, to the Roanoke Bridge Company.

Greenville, Tex.—Constructing a concrete bridge over Sabine river, to the El Paso Bridge Company.

De Pere, Wis.—Constructing a reinforced concrete bridge, to Martin Pink, of Woodville.

London, Wis.—Constructing the Shawano-Door street bridge, to the Worden Allen Co., Milwaukee, Wis., $15,885.

CONTEMPLATED WORK.

Quincy, Ill.—The board of supervisors have appropriated $14,939 for bridge construction.

Jackson, Miss.—Bids will be asked soon for a steel bridge over Pearl river, near Jackson. Board of supervisors of Hinds and Rankin counties.

Springfield, Mo.—The construction of a steel bridge over Wilson creek is contemplated.

San Angelo, Tex.—A $70,000 bond issue for bridge construction has been voted.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

CONTRACTS AWARDED.

Pasadena, Cal.—Constructing an incinerator plant, to William C. Crowell, $46,000.

CONTEMPLATED WORK.

Kansas City, Mo.—The construction of a garbage incinerator is contemplated. The estimated cost is $100,000.

Kenmore, O.—The construction of a garbage and sewage disposal plant is contemplated.

Morgantown, W. Va.—A site for the proposed garbage disposal plant has been obtained and bids will be asked immediately by the mayor and three members of the council.

STREET LIGHTING.

BIDS REQUESTED.

Fremont, O.—Lighting the city for a period of 10 years, to the Yarman Company, $57.50 per lamp, per year.

CONTRACTS AWARDED.

Olivet, Mich.—Lighting the streets of the village, to the Commonwealth Power Co.

Rochester, N. Y.—Lighting the streets of the city, for 5 years to the Rochester Railway and Light Co., $350,941 per year.

CONTEMPLATED WORK.

Port Byron, Ill.—The construction of a street lighting system is contemplated by the village. W. D. Hall, president of village board; F. B. Skelton and G. B. Tolman, light committee.

Lehigh, Ia.—A $20,000 bond issue for the erection of a water works and electric light plant has been voted.

Clearwater, Kas.—A $32,000 bond issue for water works and light improvement has been voted.

Norton, Kas.—A $20,000 bond issue for the construction of an electric light plant has been voted. R. M. Hemphill, city clerk.

Grand Rapids, Mich.—The installation of an ornamental lighting system on North Division avenue is contemplated.

Ellwood, Neb.—A $5,000 bond issue for electric light improvements has been voted.

Bellevue, O.—An ordinance providing $35,000 for an electric light plant has been voted.

Olmstead Falls, O.—A $5,000 bond issue for electric light improvements has been voted. A. E. Atkinson, village cuerk.

Sharon, O.—The city council has voted to build a municipal electric light plant at an estimated cost of $85,000.

Wellsville, O.—A $60,000 bond issue for a municipal lighting plant has been voted. A. S. Campbell, clerk of council.

Oklahoma City, Okla.—The Oklahoma Gas & Electric Co. will install street lights for the city.

Norristown, Pa.—The city has purchased a site for an electric light plant.

Camden, S. C.—A $100,000 bond issue for water and light improvement has been voted.

Garretson, S. D.—A $6,000 bond issue for electric light improvements has been voted. C. O. Berdahl, mayor.

FIRE APPARATUS.

BIDS REQUESTED.

Sharon, Pa.—Aug. 6, 12 m. Furnishing an automobile fire engine. Oscar J. Denny, borough secretary.

CONTEMPLATED WORK.

Bakersfield, Cal.—A $60,000 bond issue for the fire department has been voted.

St. Petersburg, Fla.— A $10,000 bond issue for fire department improvement has been voted.

Quitman, Ga.—A committee has been authorized to purchase an automobile fire truck, similar to those used in Macon, Augusta and Savannah.

Council Bluffs, Ia.—The purchase of a new auto fire truck and a street flusher and the building of a new fire station is contemplated by the city council.

Waterloo, Ia.—The purchase of a motor combination chemical and hose truck is contemplated by the city. City clerk.

Lynn, Mass.—A $28,500 bond issue has been voted for motor fire apparatus.

Albany, N. Y.—The purchase of several tractors is contemplated by the city.

Pittsburgh, Pa.—Director Morin, of the Department of Public Safety, has asked for a $700,000 bond issue for motor fire and police apparatus.

Dallas, Tex.—A $125,000 bond issue for fire department improvement has been voted.

Paris, Tex.—A $140,000 bond issue for sewer and fire department has been voted.